

INFORME DE PRODUCCIÓN CIENTÍFICA 2020



UNIVERSIDAD
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**INFORME DE
PRODUCCIÓN
CIENTÍFICA
2020**

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INFORME DE PRODUCCIÓN CIENTÍFICA 2020



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PRESENTACIÓN

Durante los últimos años, la Universidad Panamericana ha apoyado las labores de investigación de su comunidad de diversas formas, tales como la definición de políticas y programas de fomento. Esto ha permitido un crecimiento sin precedentes en la formación de nuevos doctores y en los resultados de producción científica.

Este esfuerzo, acentuado en los últimos seis años, permitió afianzarnos en 2020 como la segunda universidad privada en México con el mayor volumen de producción científica indexada en Scopus, así como un aumento importante en el número de miembros del Sistema Nacional de Investigadores, 147 a la fecha. Un reconocimiento especial al Dr. José Antonio Lozano Díez, quien con su visión, impulsó la investigación durante este período.

Como resultado de este esfuerzo, la Universidad ha crecido en reconocimiento, visibilidad y posicionamiento a nivel internacional, logros que compartimos con quienes lo han hecho posible, y esto nos lleva a proponernos nuevos retos y mayores desafíos.

Es necesario seguir impulsando la calidad de nuestras publicaciones, ya que su impacto científico redundará en oportunidades de diálogo y colaboración de nuestros profesores con especialistas a nivel internacional, pero también en impacto social, ya que con esto contribuimos de manera directa al ideario de nuestra Universidad, donde nos proponemos dar respuesta a los problemas y retos a los que nos enfrentamos como país y como sociedad.

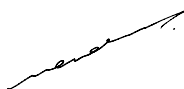
Como ejemplo de ello, destacamos en el presente Informe de Producción Científica 2020, investigaciones originales y aportaciones concretas relacionadas con el COVID-19, desde diferentes perspectivas del conocimiento.

Para los próximos años, la Universidad Panamericana dirigirá esfuerzos en detectar, gestionar y materializar oportunidades de financiamiento con el objetivo de ampliar la inversión en investigación y, con ello, fortalecer nuestros alcances en materia científica y técnica, así como su impacto y beneficios sociales.

Es bien sabido que el bienestar humano y el progreso social en su conjunto dependen, entre otras muchas cosas, de nuestras capacidades para crear e inventar nuevas obras en las esferas de la tecnología y la cultura. Por ello, será también prioritario el impulso hacia una mayor cultura de los derechos de propiedad intelectual.

La promoción y protección de este derecho, estimulan el crecimiento económico y, eventualmente, elevan la calidad de vida de las personas. Convencidos de esto, trabajaremos también en la creación de mecanismos y procesos eficaces para lograr una transferencia adecuada de nuestros resultados de investigación.

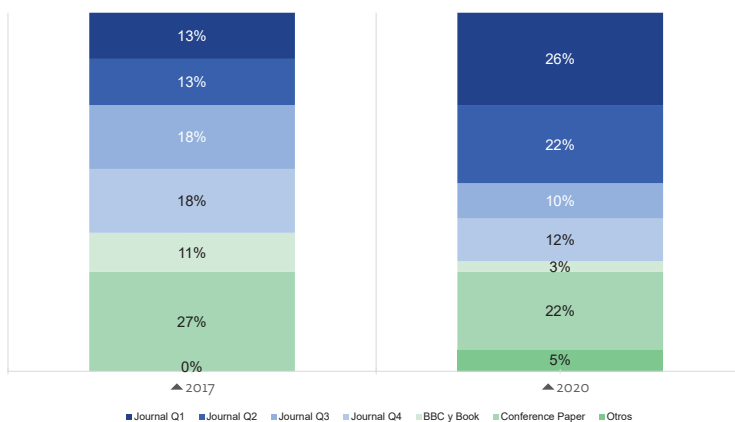
En representación del Consejo Institucional de Investigación, expreso nuestro más sincero reconocimiento a toda la comunidad académica y directiva que han motivado y trabajado por el cumplimiento de los objetivos trazados en materia de investigación.



Dr. Abraham Mendoza Andrade
Director Institucional de Investigación
Universidad Panamericana

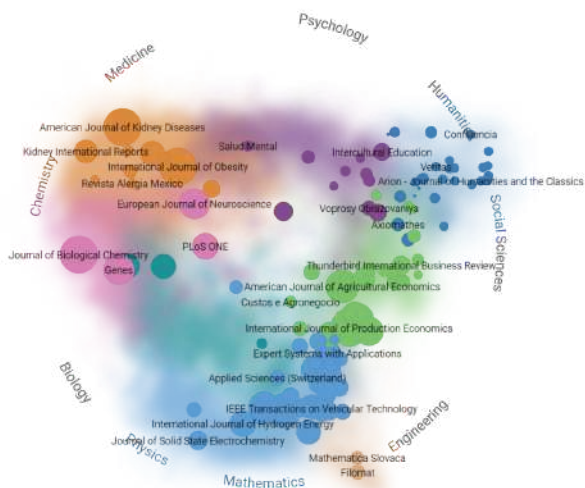
NUMERALIA

Figura 1. Comparativo de calidad entre las publicaciones de 2017-2020



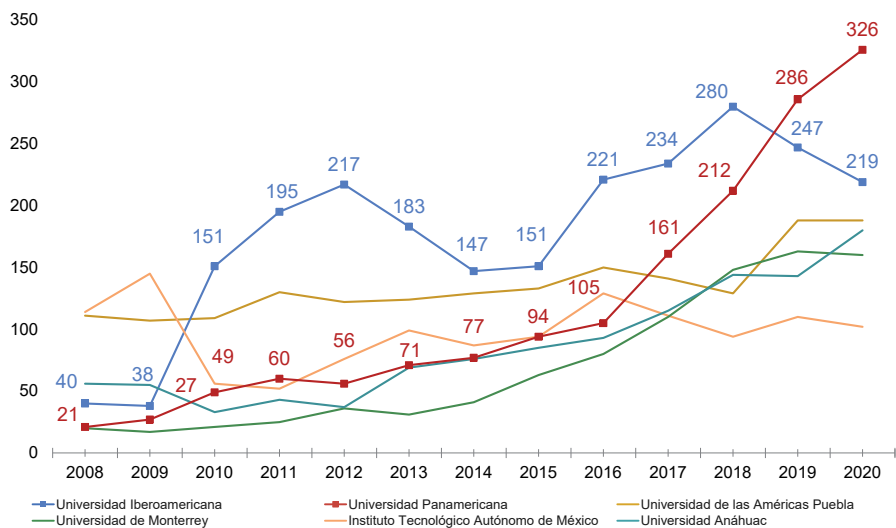
Fuente: elaboración propia con datos de Scopus y Scimago Journal Ranking.

Figura 2. Perfil de áreas temáticas



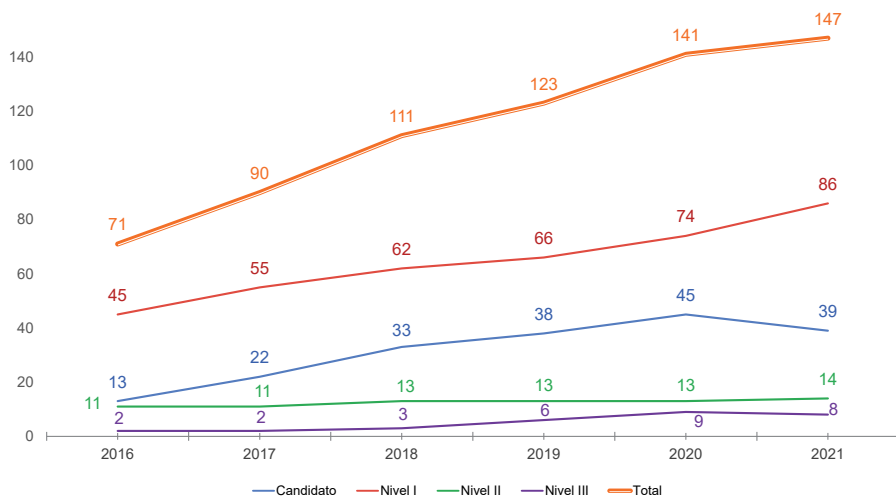
Fuente: Scimago con datos de Scopus.

Figura 3. Benchmark de universidades privadas mexicanas 2010-2020



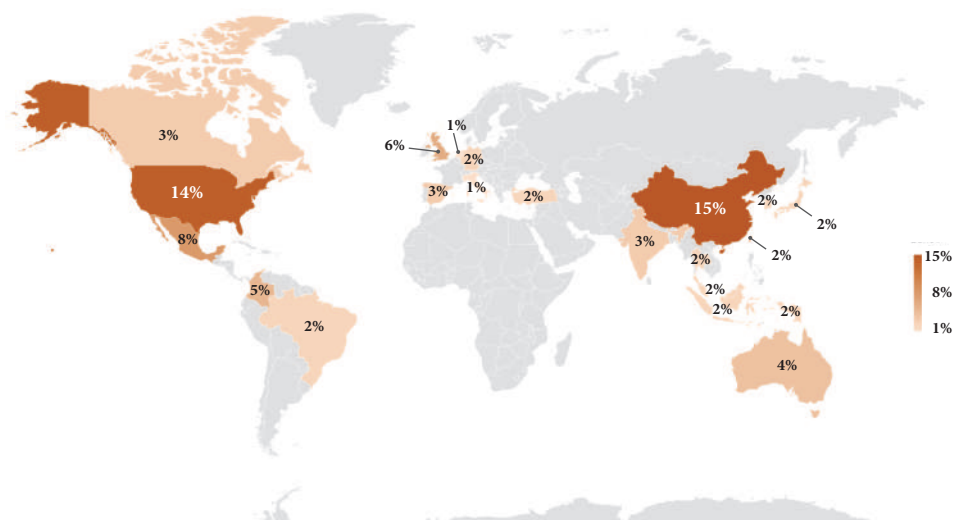
Fuente: Scopus, universidades privadas con menos de 1000 publicaciones por año. Corte: 25 de febrero de 2021.

Figura 4. Miembros del Sistema Nacional de Investigadores



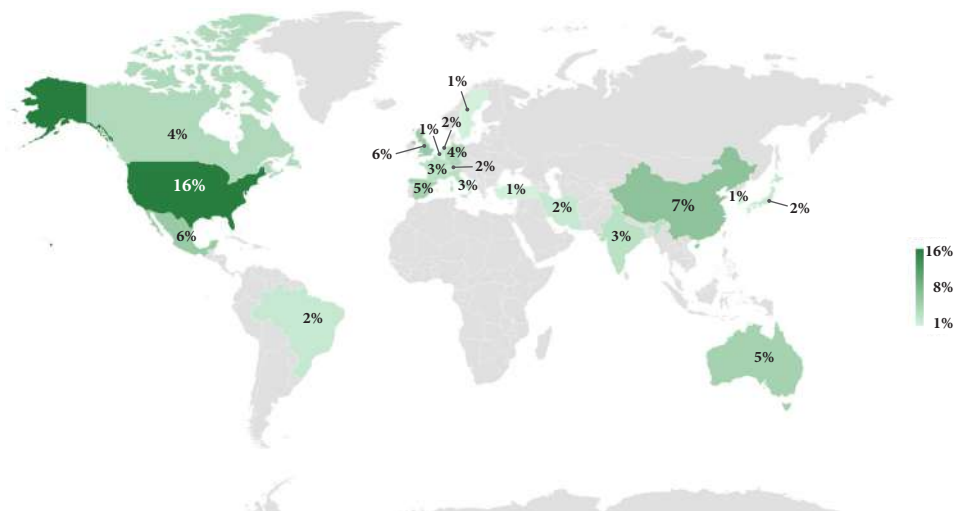
Fuente: elaboración propia con datos del CONACYT.

Figura 5. Principales lectores de nuestras publicaciones en el mundo



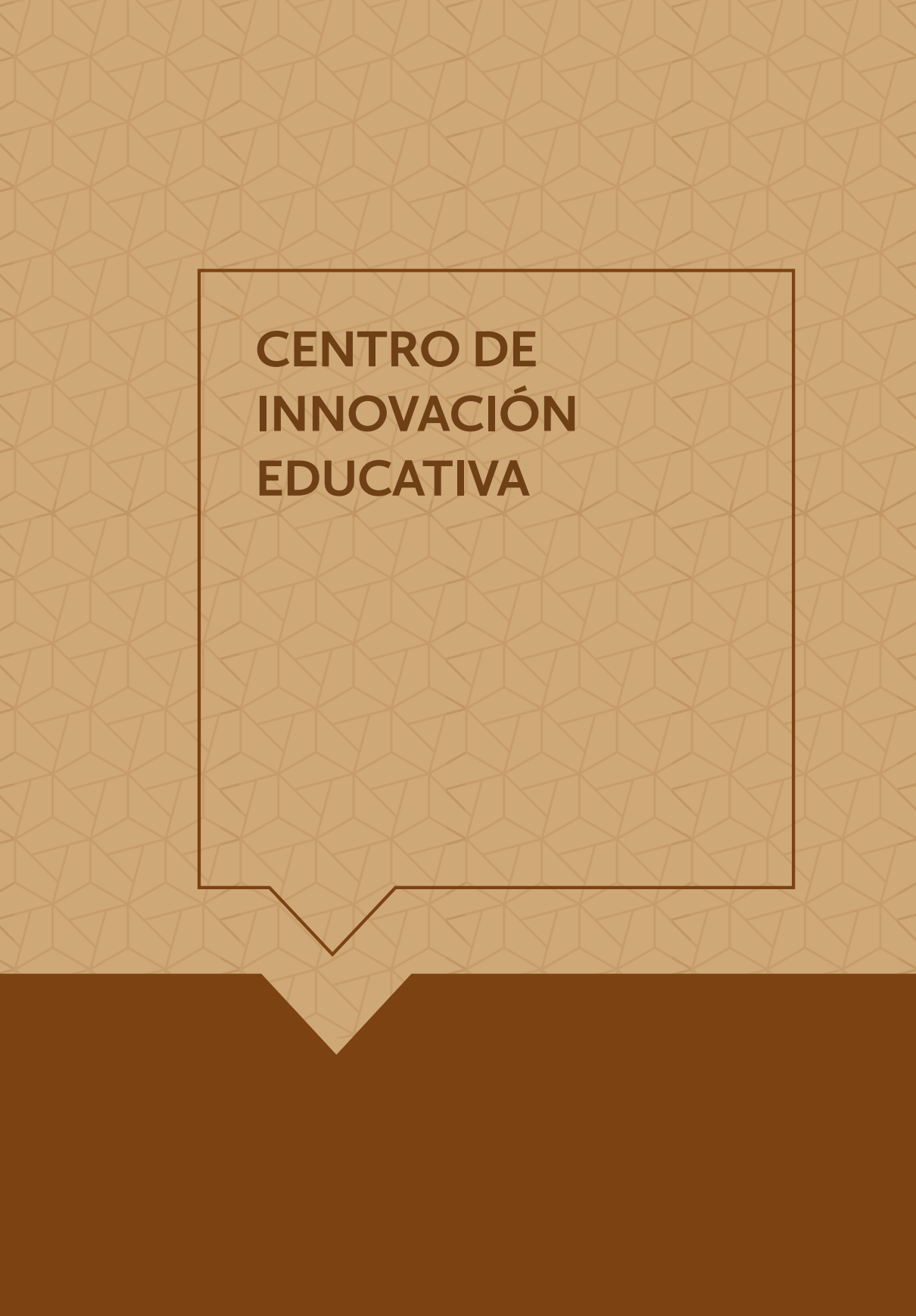
Fuente: Elsevier con tecnología de Bing.

Figura 6. Principales lugares de citación de nuestras publicaciones en el mundo



Fuente: Elsevier con tecnología de Bing.





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REVISTA DE INTEGRIDAD ACADÉMICA: AN EFFORT TO FOSTER ACADEMIC INTEGRITY IN UNIVERSIDAD PANAMERICANA

ABSTRACT. As an effort to promote a culture of AI in Latin America, and specifically in Mexico, Universidad Panamericana developed an online publication called: Revista de Integridad Académica, with four universities in the region: Universidad EAFIT at Colombia, Tecnológico de Monterrey and Universidad de Monterrey at Mexico, and the Pontificia Universidad Católica de Chile. The publication seeks to disseminate and promote academic integrity values among universities in Latin America. Its long term-purpose is to emerge as an international reference on the topic. In this paper, we present an initial approach to a theoretical framework of AI in Latin America. Next, we relate this framework to the creation of Revista de Integridad Académica as a strategy to foster AI in Universidad Panamericana. Finally, we explain how the publication has grown to become periodical, as a result of inter-institutional collaboration and its digital impact. ©2019 IATED Academy.

Alemán-Juárez, A., Becerra-Mariscal, A. E., & García-Higuera, M.C. (2018). Revista de Integridad Académica: An Effort to Foster Academic Integrity In Universidad Panamericana. *EDULEARN18 Proceedings*. 10th International Conference on Education and New Learning Technologies (Spain), La Palma (pp. 5499-5502). doi: 10.21125/edulearn.2018.1325. Conference Paper.

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IMPROVING RETENTION AND SOFT SKILLS THROUGH PROJECT-BASED LEARNING: A PROPOSAL OF THE COLLEGE OF ENGINEERING AND THE CENTER FOR INNOVATION IN EDUCATION AT UNIVERSIDAD PANAMERICANA

ABSTRACT. Our understanding of teaching and learning in higher education has changed dramatically in recent years. New models of teaching refer to stu-

dent-centered, active participation, and technology and social media integration among others. Besides, since 2003, ABET, the accreditation board for engineering and technology programs, introduced a set of skills, called professional skills that engineering graduates should possess such as multidisciplinary teamwork, ethical responsibility, effective communication, and life-long learning. Despite these efforts, a gap has been identified in the skills graduates have and those needed to succeed in the workplace.

Moreover, pre-college preparation plays a significant role in the level of success in STEM courses, and in consequence in the decision of students to stay in their programs. For some students, first-year STEM courses are easy to take, and for others, they are very challenging and frequently they do not succeed.

To address the previous problems, the College of Engineering at Universidad Panamericana partnered with the Center for Innovation in Education to redesign the introductory physics course. The primary objective of the course is to teach pre-college physics through project-based learning (PBL) and to develop soft skills through well-designed activities.

This paper is divided into two sections. The first section presents a description of the physics course including the design characteristics, the number of sections taught and the number of students attending the class, and a brief description of the professors.

The second section describes preliminary results of the focus group interview with the students participating in the class. Students described professors' strengths and challenges in teaching the course such as their patience, the knowledge of the subject, and their difficulties of planning and managing time in the redesigned course. Also, the students refer to their learning experience as challenging and rewarding. They share how they were able to develop soft skills such as creativity, and critical thinking, problem-solving, and verbal communication among others. Finally, students shared how they were able to relate the class content with the practical profession of engineering.

García-Higuera M. C., Niembro-García, I. J., & Alemán-Juárez, A. (2019). Improving Retention and Soft Skills Through Project-Based Learning: A Proposal of The College Of Engineering And The Center For Innovation In Education At Universidad Panamericana. *EDULEARN18 Proceedings*. 10th International Conference on Education and New Learning Technologies (Spain), La Palma (pp. 1707-1712). doi: 10.21125/edulearn.2018.0502. Conference Paper.

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**IMPROVING STUDENT RETENTION AND
SOFT SKILLS: FACULTY EXPERIENCES ON
TRANSITIONING TO ACTIVE LEARNING
APPROACHES ON FIRST-YEAR ENGINEERING
PROGRAMS AT UNIVERSIDAD PANAMERICANA**

ABSTRACT. Motivation and problem background. This complete evidence-based practice paper describes the pedagogical redesign process of an introductory physics course for first-year engineering students at Universidad Panamericana, and the experience of professors that applied problem and project-based learning methodologies. Teaching and learning concepts and approaches in higher education are experiencing dramatic transformations due to contextual changes in recent years. Contemporary teaching models are student-centered, and based on active learning, technology, and social media integration. Engineering education research has grown exponentially and even though there is vast evidence of how different teaching practices can improve learning, professors still face a lot of barriers to include them in their practice. Adequate transfer of conceptual knowledge to problem solving requires appropriate pedagogies that ensure student engagement in the learning process. Quality of instruction and pre-college preparation are key for student success in STEM courses, and therefore, in the decision of students to stay in their programs (Chen & Soldner, 2013). In Mexico, according to ANFEI (National Association of Colleges and Schools of Engineering), only 40% of engineering students graduate on time. First-year course are easy for some students, but represent a big challenge for others, who frequently do not succeed (Vargas Leyva & Jiménez Hernández, 2015). In addition, research has shown that student's prior mathematics and physics training, as well as their academic attitude, influence their decision to stay in STEM majors (Astin, 1993). Besides, since 2010, Universidad Panamericana has deployed a series of strategies to help students strengthen the professional skills. These strategies include skills ABET proposed for engineering graduates, such as multi-disciplinary teamwork, critical thinking, and effective communication. Nevertheless, there is still a significant gap between the skills engineering graduates need to succeed in the workplace and those developed through college experience. To address the previous concerns, the Center for Innovation in Education was invited to collaborate with the Col-

lege of Engineering at Universidad Panamericana to redesign an introductory physics course. Problem and Project-based Learning (PBL) methodologies were chosen to teach the course and strategies to develop students' soft skills were included. The course was taught in the fall of 2017. This paper is divided into two parts. In the first part we describe the redesign process that the Center for Innovation in Education followed in collaboration with three engineering faculty members teaching the course. The second part we present the experiences of the eight professors that taught the redesigned course. ©2019 American Society for Engineering Education.

García-Higuera, M. C., Chavez-Telleria, M. R., Alemán-Juárez, A. & Niembro-García, I. J. (2019). Improving Student Retention and Soft Skills: Faculty Experiences on Transitioning to Active Learning Approaches on First-Year Engineering Programs At Universidad Panamericana. *2019 ASEE Annual Conference & Exposition*. 126th ASEE Annual Conference and Exposition, Conference Proceedings (Estados Unidos), Tampa. doi: 10.18260/1-2--32948. Conference Paper.

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**EXPERIENCE OF THE CENTER FOR INNOVATION IN
EDUCATION ENGAGING COLLEGE PROFESSORS
IN THE USE OF NEW TECHNOLOGIES. THE "VIRTUAL
AND AUGMENTED REALITY SHOWROOM" PROJECT**

ABSTRACT. This paper describes the "Showroom of Virtual and Augmented Reality" project developed by the Center for Innovation in Education at Universidad Panamericana during the spring of 2019. The purpose of this project is to engage professors in the use of new technologies in the classroom.

The recent development of instructional models based on simulation has helped education to introduce new tools and develop new teaching methodologies to enhance learning. A study about integrating augmented reality in the classroom suggests that the methodology can foster novelty towards learning and can improve interaction with learning through the establishment of spatial concepts (Mark, Graham and Barbara, 2004). Similarly, research has shown that Augmented and Virtual Reality (VAR) can improve motivation and concentration of students in order to obtain better learning effects (Yeh, 2004, Chen, Wu, & Zhung, 2006; Yen, Tsai & Wu, 2013). Even though ed-tech experts predict an acceleration of activity including virtual reality in classes, they caution the need of sound pedagogical foundations (McMurtrie, 2019).

College professors are experts on course content, but generally they are not familiar with the

educational trends or the learning methodologies. The Center for Innovation in Education aware of this necessity, develop a strategy to introduce professors to the use of VAR in the classroom in order to develop new learning experiences. The project was implemented in May 2019, 17 professors participated from eight different schools and colleges. The experience started with a short presentation about Virtual and Augmented Reality and its advantages and disadvantages on the industry and in education. Then, we presented four experiences were professors use different VR viewers from low cost Google Cardboards, to more expensive Oculus Rifts. In each station, we provide personalized attention regarding the use of the technology in the different disciplines.

Finally, we present the shared experiences of professors who participated in the Showroom, which include the initial excitement to use VR and AR and the uncertainty and lack of confidence of using technology in the classroom.

After this Showroom, four professors decided to start using VAR in the classroom during the fall semester of 2019. In addition, the College of Engineering asked for a second Showroom experience to present to professors.

Ruiz-Leyva, M. L. & García-Higuera, M. C. (2019). Experience of The Center For Innovation In Education Engaging College Professors In The Use of New Technologies. The "Virtual And Augmented Reality Showroom" Project. *ICER12019 Proceedings*. 12th annual International Conference of Education, Research and Innovation (Spain), Sevilla (pp. 2292-2296). doi: 10.21125/iceri.2019.0623. Conference Paper.

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VIRTUAL DETECTIVE: A ROLE PLAYING EXPERIENCE THROUGH AUGMENTED REALITY TO ENHANCE RESPONSIBLE ALCOHOL CONSUMPTION AMONG UNIVERSITY STUDENTS IN MEXICO

ABSTRACT. This paper describes the learning experience designed by combining augmented reality, role playing and storytelling to improve university students' knowledge on responsible alcohol consumption. Five implementations of the experience were done along the august-december 2018 semester; 122 students participated from 8 schools and faculties and 13 different undergraduate programs. Students' knowledge on responsible alcohol consumption was evaluated at the beginning of the experience through a gamified test. Then they learned important facts about responsible alcohol consumption by solving a case, using augmented reality; and finally, they were tested again. Results show that 92.72% of students considered that this experience helped them learn in a more creative and memorable way, and sparked their motivation and curiosity; 76.53% declared the experience design helped them deepen on their knowledge about this topic; and finally, their knowledge on responsible alcohol consumption improved by 16.83% as shown by their performance on the initial and final tests. ©2019 IATED Academy.

Ruiz-Leyva, M. L. & García-Higuera, M. C. (2019). Virtual Detective: A Role Playing Experience Through Augmented Reality To Enhance Responsible Alcohol Consumption Among University Students In Mexico. *INTED2019 Proceedings*. 13th International Technology, Education and Development Conference (Spain), Valencia (pp. 9446-9452). doi: 10.21125/inted.2019.2337. Conference Paper.

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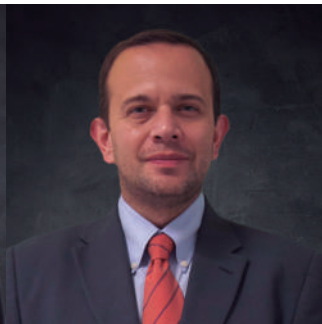
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AN UNDERSTANDING OF REALITY IN A NEO-PLATONIC KEY. TWO PASSAGES OF ST. AUGUSTINE'S DE ORDINE

[UNA COMPRESIÓN DE LA REALIDAD EN CLAVE NEOPLATÓNICA. DOS PASAJES DEL DE ORDINE DE SAN AGUSTÍN]

ABSTRACT. Understanding the reality of the world and then justifying the path of interiority, the interaction between “knowing” and “knowing oneself”, constitutes the Augustinian sapiential nucleus. De ordine places us right at the beginning, in dialogue with Neoplatonism. The text refers to Providence and then to the *ordo rerum*, apparently refuted by the scandal of evil; indeed, it is not possible to affirm that nothing happens outside of Providence, if the original event of evil cannot be reconducted to the order of God. Augustine resorts to the aesthetic argument: The light of being is turned off for those who are not able to fully enjoy beauty. This requires, since Plato, an asceticism of the senses, which is maintained here through the assiduous study of the Liberal Arts. Two passages allow us to calibrate the Augustinian accesses to the whole of the real: The sound of water at midnight and a fight of roosters.

Calabrese, C. C. (2020). An understanding of reality in a neo-platonic key. Two passages of St. Augustine's *de Ordine* [Una comprensión de la realidad en clave neoplatónica. dos pasajes del *de ordine* de San Agustín]. *Revista de Humanidades*, 41, 105-128. Article.

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CLASSICAL TRADITION AND JUDEO-CHRISTIAN REVELATION IN CLEMENT OF ALEXANDRIA

ABSTRACT. Clement of Alexandria is one of the most iconic intellectuals of primitive Christianity. His attitude towards Classical Greek culture had a decisive role in its acceptance as an appropriate instrument for the interpretation of biblical revelation. In the context of the present article, we follow the Clementine account of the Orphic texts, an interpretation distinguished by its manner of tackling the issue. This meant not only that he ignored the context in which the “Orphic tradition” developed, but also that he set aside the immanent quality of Greek culture. Clement's approach would have a deep impact on the way in which Late Antiquity Christi-

anity would understand divine nature and the limits of the act of faith.

Calabrese, C. & Bravo, N. (2020). Classical tradition and Judeo-Christian revelation in Clement of Alexandria. *Graeco-Latina Brunensia*, 25(1), 47-60. doi: 10.5817/GLB2020-1-4. Article.

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CULTURAL AND PERSONAL SENSE OF THE DISEASE ACCORDING TO THOMAS MANN

[SENTIDO CULTURAL Y PERSONAL DE LA ENFERMEDAD SEGÚN THOMAS MANN]

ABSTRACT. The objective of this article is to present a notion of the concept of disease from a humanistic and non-scientific approach. Faced with a perspective of science based on experimentation and technology, we propose a deliberation that integrates the artistic-literary paradigm. A hermeneutic analysis is applied on the topic of the disease in Thomas Mann's narrative to describe its predominant functions. The result is the revision of the conventional relationships between culture, life and health, compared to the meaning proposed by the author. The reinterpretation of the possibilities of the disease is transferred from the physical expression to the metaphysical dimension. The conclusions propose the affinity of times between the present of the author and ours, as well as the integration of humanistic knowledge and the use of the literary-imaginative resource for the therapy of the health professional.

Calabrese, C. C. & Junco, E. (2019). Cultural and personal sense of the disease according to Thomas Mann [Sentido cultural y personal de la enfermedad según Thomas Mann]. *Cultura de los Cuidados*, 23(55), 45-56. doi: 10.14198/cuid.2019.55.05. Article.

Claudio César Calabrese Ruíz

Investigador Titular D, SNI Nivel I

PLATO AND THE CAVE ALLEGORY AN INTERPRETATION BEGINNING WITH VERBS OF KNOWLEDGE

ABSTRACT. In this paper we study the organization of the allegory of the cavern through the investigation of knowledge verbs. First, we briefly follow the interpretations of the allegory of the cave that we consider most significant and our perspective: all are

valid provided that each does not deny the others. At our core we analyze the verbs of knowledge: how they relate to each other and what structure of knowledge they establish. In the conclusion, we affirm that the verbs do not present a vision of being as "what is", but as "what is being"; this means, with respect to the allegory, that the relation between being and intelligibility means a pathway of mutual equalization, which the prisoner of the cave goes through; nevertheless, the attempt to reach a comprehensive intelligence of the being requires one more step: to integrate the phenomena to the comprehension of the real thing.

Calabrese, C. C. (2020). Plato and the cave allegory an interpretation beginning with verbs of knowledge. *Schöle*, 14(2), 431-447. doi: 10.25205/1995-4328-2020-14-2-431-447. Article.

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SAINT AUGUSTINE AND THE TRANSFORMATIONS OF THE SKEPTICAL GAZE. THE FIGURE OF PROTEUS IN 'CONTRA ACADEMICOS'

[SAN AGUSTÍN Y LAS TRANSFORMACIONES DE LA MIRADA ESCÉPTICA. LA FIGURA DE PROTEO EN CONTRA ACADÉMICOS]

ABSTRACT. This paper studies the transformation of the foundations of ancient skepticism in Augustinian thought; to present the process we start from the crisis that led to the break with Manichaeism experience, we distinguished their concern and consideration about the mode and limits of knowledge and analyzed the function of Proteus's mythical image in *Contra academicos*; this image allows us to weigh the capacity of mythical representation as a buttress of the discursive character of human knowledge. Through this resource, St. Augustine affirms that reason cannot be isolated from other complementary modes of understanding, appropriates the core of the skeptical attitude and broadens the notion of rationality for Christian philosophy.

Calabrese, C. C. (2020). Saint Augustine and the transformations of the skeptical gaze. The figure of Proteus in 'Contra Academicos' [San Agustín y las transformaciones de la mirada escéptica. La figura de Proteo en *Contra Academicos*]. *Veritas*, 45, 121-140. doi: 10.4067/S0718-92732020000100121. Article.

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SNI Nivel I

MUTATION AND CONCEPT IN ERNST CASSIRER. TWO VALIDATION WAYS OF THE SINGULAR

[MUTACIÓN Y CONCEPTO EN ERNST CASSIRER. DOS FORMAS DE VALIDACIÓN DEL SINGULAR]

ABSTRACT. This paper analyzes the relation between the singular and the universal in mythical thinking. The initial problem holds that, conventionally, due to its fantastic expressions, mythical thought is non-objective knowledge of the world; however, I will argue the opposite. Based on Cassirer's *Philosophie der symbolischen Formen*, I will present two results: firstly, an evaluation of how myth relates singular events with universal concepts, which allows the reassessment of myth as a valid epistemological form. Secondly, the main epistemological resource of myth is the idea of mutation, unlike science, which uses concepts to relate the singular with the universal.

Esparza, G. (2019). Mutation and concept in Ernst Cassirer. Two validation ways of the singular [Mutación y concepto en Ernst Cassirer. Dos formas de validación del singular]. *Signos Filosóficos*, 21(42), 82-109. Article.

Gustavo Adolfo Esparza Urzúa

SNI Nivel I

THE RELATIONAL KNOWLEDGE OF SINGULAR ON ERNST CASSIRER

[EL CONOCIMIENTO RELACIONAL DEL SINGULAR EN ERNST CASSIRER]

ABSTRACT. This paper deepens the proposed solution on the knowledge of the singular developed by Ernst Cassirer. The problem arises that the relationship between the particular and the general is already conceived in the first studies of the author until crystallizing in his proposal to exchange substantive concepts for functional concepts. This methodological exchange will allow the neo-Kantian to base, eventually, (1) the *Philosophie der Symbolischen Formen* as a worldview that conceives culture as a universal criterion of meaning of all human actions and (2) the symbol as a harmonic functional unit between the singular and the universal. © PENSAMIENTO.

Esparza, G. (2019). The relational knowledge of singular on Ernst Cassirer [El conocimiento relacional del singular en Ernst Cassirer. *Pensamiento*, 75(287), 1491-1509. doi: 10.14422/pen.v75.i287.y2019.006. Article.

Gustavo Adolfo Esparza Urzúa

SNI Nivel I

Federico Nassim Bravo Jordán

SNI Nivel C

THE SILENT INVASION OF INTELLIGENT TECHNOLOGY. A REREADING OF "LOS CABALLOS DE ABDERA" BY L. LUGONES

[LA INVASIÓN SILENCIOSA DE LA TECNOLOGÍA INTELIGENTE. UNA RELECTURA DE "LOS CABALLOS DE ABDERA" DE L. LUGONES]

ABSTRACT. In this paper, the epistemological boundaries between myth and science fiction are elucidated within the story "Los caballos de Abdera" (Las fuerzas extrañas). It is shown that even though the narrative treatment proposed by the Argentine author is not science fiction, it offers a model of the naturalization of fantastic events. In the first part we discuss the hermeneutical keys of this Lugonian reading, underscoring the flexibility of myth to adapt itself to the narrative paradigms of different ages. Using this plasticity of the mythical form, in the second part we analyze the process of familiarization through which the excessive use of technology in our daily lives has become normal. The purpose of this is to outline one of the recurring themes in science fiction: the invasion of alien beings.

Esparza, G. & Bravo, N. (2020). The Silent Invasion Of Intelligent Technology. A Rereading of "Los caballos de Abdera" by L. Lugones [La invasión silenciosa de la tecnología inteligente. Una relectura de "Los caballos de Abdera" de L. Lugones]. *Amaltea*, 12, 13-23. doi: 10.5209/AMAL.66682. Article.

Gabriela García Zerecero

Profesor investigador

MOLECULAR MODELS AND SCIENTIFIC REALISM

ABSTRACT. The practice of theoretical research in chemistry largely consists in the construction of models without which experimentation would be impossible. The best-known theoretical models in chemistry are those of the molecular structures of chemical compounds. What is the correspondence between these models and the unobservable entities that they are meant to explain? What is the ontological status of molecular models? The anti-realists question the basis of the realists' belief in these entities and the truth claims regarding them. Ultimately, the realist/anti-realist debate points to the question of the scope of scientific knowledge. In this paper, I shall show that the description of natural entities offered by the contemporary scientific worldview

reveals that molecular modeling presupposes a realistic epistemology that recognizes the limits of scientific objectification.

Zerecero, G. G. (2020). Molecular models and scientific realism. *Foundations Of Chemistry*, 22, 467-476. doi: 10.1007/s10698-020-09363-7. Article in Press.

Vicente de Haro Romo

SNI Nivel I

DUTY OF BENEFICENCE IN KANT AND FICHTE

[EL DEBER DE BENEFICENCIA EN KANT Y FICHTE]

ABSTRACT. This paper presents Kant's and Fichte's arguments to put forward the ethical and particular duty of beneficence. It appraises both philosophers' reasons to locate this duty in a special position in their respective system of duties, contrary to the general criteria of these systems. It also comments in a comparative way, on the role of the faculty of judgment towards the margin of latitude that this ethical duty implies in each of both thinkers.

Haro, V. de (2020). Duty of Beneficence in Kant and Fichte [El deber de beneficencia en Kant y Fichte]. *Ideas y Valores*, 69(174), 123-141. doi: 10.15446/ideasyvalores.v69n174.67642. Article.

Ethel Beatriz Junco de Calabrese

Investigador Titular D, SNI Nivel I

AFFIRMATION OF THE SACRED IN THE FAIRY TALE

[AFIRMACIÓN DE LO SAGRADO EN EL CUENTO MARAVILLOSO]

ABSTRACT. We study the fairy tale according to texts of the Brothers Grimm anthology, to highlight the sacred character of the hero's path, in order to relate the geographical journey with the learning transit of the soul. After establishing the dimensions of the tale in accord with its literary, philosophical, religious and pedagogical statute, we conclude affirming that the fairy tales clarify the relationship of man and nature and conceive them as integrated to a sacred order.

Junco, E. (2019). Affirmation of the sacred in the fairy tale [Afirmación de lo sagrado en el cuento maravilloso]. *Open Insight*, 10(20), 145-167. doi: 10.23924/oi.v10n20a2019.pp%25p.345. Article.

Ethel Beatriz Junco de Calabrese

Investigador Titular D, SNI Nivel I

Claudio César Calabrese Ruíz

Investigador Titular D, SNI Nivel I

THE ORPHIC CONDITION IN WONDROUS NARRATIVE: THREE PERRAULT'S TALES

[LA CONDICIÓN ÓRFICA EN LA NARRACIÓN MARAVILLOSA: TRES CUENTOS DE PERRAULT]

ABSTRACT. In this article we deal with the topic of the condition, as it is present in the myth of the descent into Hades of Orpheus in search of Eurydice, in three stories by Charles Perrault. Through this topic, we investigate the nature of the original condition as well as the transformations of the characters that execute it or that suffer it. We emphasize that fairy tales recreate the axes of myth, music, death and love, and manifest a vision of the world in which the idea of anabasis and rebirth predominates based on the premise of self-knowledge. We conclude that the mythical motive articulates the stories as an intertext, even when the variants of the author modify plot and relationships.

Junco, E. & Calabrese, C. C. (2019). La condición órfica en la narración maravillosa: Tres cuentos de Perrault. *Cedille*, 16, 295-312. Article.

Laura Yadira Munguía Ochoa

Investigador Titular B, SNI Nivel I

OF LOVE AND LABYRINTHS: USE OF THE CRETAN CYCLE IN LOPE DE VEGA, CALDERÓN AND SOR JUANA INÉS DE LA CRUZ

[DE AMORES Y LABERINTOS: UTILIZACIÓN DEL MITO CRETENSE EN LOPE DE VEGA, CALDERÓN Y SOR JUANA]

ABSTRACT. In this research an analysis was made between three literary works: The Labyrinth of Crete by Lope de Vega (1621), Love the Greatest Labyrinth by Sor Juana Inés de la Cruz (1689) and The Three Greatest Wonders by Calderón de la Barca (1641) by a comparative study on the sources and their use in the mentioned comedies. Special attention was paid to the development of the female characters of the three comedies, and the influence of Lope de Vega prevailed over the other two playwrights as well as the argumentative primacy of the characters of Ariadne and Phaedra.

Munguía, Y. (2019). Of love and labyrinths: Use of the Cretan cycle in Lope de Vega, Calderón and sor juana inés de la Cruz [De amores y laberintos: Utilización del mito cretense en Lope de Vega, Calderón y sor Juana]. *Hipogrifo*, 7(2), 497-510. doi: 10.13035/H.2019.07.02.39. Article.

Laura Yadira Munguía Ochoa

Investigador Titular B, SNI Nivel I

SOR JUANA AND HER ENIGMAS OFRECIDOS A LA CASA DEL PLACER: NEW APPROACHES AND PERSPECTIVES

[SOR JUANA Y SUS ENIGMAS OFRECIDOS A LA CASA DEL PLACER: UN ACERCAMIENTO A NUEVAS PERSPECTIVAS]

ABSTRACT. The enigmas offered to the House of Pleasure of sor Juana Inés de la Cruz, are a little-used work of our Tenth Muse, its trajectory inside sor Juana studies since its discovery in 1968 by Enrique Martínez López in Lisbon, shows us that its mystery it is not only in its kind, but also in the context that forges them; both in the space-time domain, as in the people related to their invoice. The publication of the edition in 1994 by Antonio Alatorre marks a before and after in the exegesis of the generation of these redondillas (seven-syllable quatrain with alternate rhyme), because the conjectural perspective has been repeated over the years without further investigation. This study proposes a different perspective of the genesis of the text, providing new perspectives based on information from primary sources and an analysis of the previous texts of the enigmas.

Ochoa, L. Y. M. (2020). Sor juana and her enigmas ofrecidos a la casa del placer: New approaches and perspectives [Sor juana y sus enigmas ofrecidos a la casa del placer: Un acercamiento a nuevas perspectivas]. *Hipogrifo*, 8(1), 251-262. doi: 10.13035/H.2020.08.01.18. Review.

Laura Yadira Munguía Ochoa

Investigador Titular B, SNI Nivel I

Rómulo Ramírez Daza y García

Investigador Titular A, SNI Nivel I

THE ILLUMINATED THINKING OF ANA DE ZAYAS AND HER RELATIONSHIP WITH MANUEL FERNÁNDEZ DE SANTA CRUZ

[EL PENSAMIENTO ALUMBRADO DE ANA DE ZAYAS Y SU RELACIÓN CON MANUEL FERNÁNDEZ DE SANTA CRUZ]

ABSTRACT. Ana de Zayas, creole, first manufacturer of networks and married, and then separated by authorization of Manuel Fernandez de Santa Cruz, self-proclaimed in her writings as «wife of Christ» without taking any veil and from his position of lay, was protected by Bishop Fernández de Santa Cruz although she was accused at 45 years before the Holy Office by vehement lighting in 1694. However, his inquisitorial process was not concluded thanks to the intervention of the same character and remained

with cause dismissed for unknown reasons. His particular thought will be explained in the light of the documentation of the inquisitorial process and his close relationship with the Bishop of Puebla.

Ochoa, L. Y. M., Ramírez-Daza, R. (2019). The illuminated thinking of Ana De Zayas and her relationship withmanuel Fernández de Santa Cruz [El pensamiento alumbrado de Ana De Zayas y su relación conmanuel Fernández de Santa Cruz]. *Edad de Oro*, 38, 249-262. doi: 10.15366/edadoro2019.38.013. Review.

Susana Ana María Ochoa Torres

Profesor investigador

GENDER INEQUALITY AND GENDER-BASED POVERTY IN MEXICO

ABSTRACT. The objective of a country's government is to increase the well-being of its population. For this reason, a precise measure of inequality and poverty contributes to better development of economic and public policies to reduce the former and latter, respectively. Therefore, in recent years, various indexes have been developed to measure and compare inequality and poverty. In the case of Mexico, the Gini and Theil indexes are used to measure both problems. However, they are criticized for the overvaluation that they generate on specific population segments. For a better measurement, this paper calculates and investigates the relationship between the Palma index (inequality) and the Foster, Greer, and Thorbecke index (poverty). In addition to reducing the overvaluation problem, the indexes mentioned allow us to perform an analysis by gender and employment type (salaried and self-employed). The main results do not diverge from those already found through traditional measures. In general, a high level of inequality exists. However, our paper contributes to the literature by identifying both problems by gender. Men present greater inequality than women, whereas women present greater poverty than men. Finally, a positive, albeit weak, correlation exists between both problems, which means that poverty can be combated by combating inequality.

Ramos, M. E., Gibaja-Romero, D. E., & Ochoa, S. A. (2020). Gender inequality and gender-based poverty in Mexico. *Heliyon*, 6(1). doi: 10.1016/j.heliyon.2020.e03322. Article.

Ruth Verónica Román Martínez

Profesor investigador

IMPRINT OF THE MODERNITY IN THE LABOUR SCOPE OF THE WOMAN WESTAND A PROPOSAL TO RECONFIGURE OF ITS FEMALE IDENTITY

[IMPRONTA DE LA MODERNIDAD EN EL ÁMBITO LABORAL DE LA MUJER OCCIDENTAL Y UNA PROPUESTA PARA RECONFIGURAR SU IDENTIDAD FEMENINA]

ABSTRACT. However, the evident development brought about by Modernity in many areas of knowledge, the way in which women live their femininity, was reconfigured from the split conception of a human person inherited from rationalism. The present analysis relates this new conception of women with respect to men and their incidence in the context of women's work; furthermore, it analyzes the resulting reactions that reconfigured women's actions. Starting from the current situation of women, we propose to combine the efforts of the actors involved and the vindication of the tasks of care as humanizing elements in coexistence.

Román Martínez, R. V. (2020). Imprint of the modernity in the labour scope of the woman westand a proposal to reconfigure of its female identity [Impronta de la modernidad en el ámbito laboral de la mujer occidental y una propuesta para reconfigurar su identidad femenina]. *Open Insight*, 11(22), 149-178. Review.



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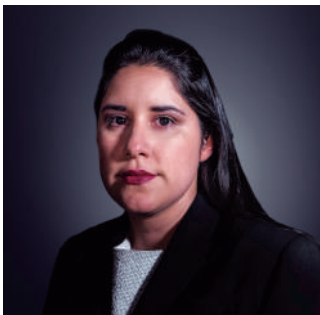
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² Colaboración en tres artículos publicados en Escuela de Pedagogía (pp. 45, 46, 47).

³ Colaboración en un artículo publicado en Facultad de Ciencias Económicas y Empresariales (p. 78).

María Luisa Azpíroz Manero

SNI Nivel I

THE DEBATE SURROUNDING GM CROPS IN SOUTH AMERICA AND ITS COVERAGE IN THE NEWSPAPERS CLARÍN AND FOLHA DE S. PAULO FROM 2016 – 2018

[EL DEBATE SOBRE LOS CULTIVOS TRANSGÉNICOS EN SUDAMÉRICA Y SU COBERTURA EN LOS DIARIOS CLARÍN Y FOLHA DE S. PAULO DE 2016 A 2018]

ABSTRACT. The cultivation and consumption of transgenic foods is a subject of global debate. Given that Argentina and Brazil are the world's largest producers of genetically modified crops after the United States, this article aims to explore the international controversy surrounding GM crops and its coverage in leading newspapers in these two countries. It aims to verify whether the press exercised its social function as an independent observer or if other interests influenced its coverage. For this, it includes a deductive content analysis of Clarín and Folha de São Paulo's coverage of GM crops from 2016 to 2018. It concludes that Clarín's coverage was more clearly pro-transgenic than that of Folha de São Paulo, which could be attributed to greater presence of pro-transgenic sources at Clarín, in addition to historical and economic factors that could have influenced the way these newspapers covered transgenic topics.

Azpíroz, M. L. (2020). "The debate surrounding GM crops in South America and its coverage in the newspapers Clarín and Folha de S. Paulo from 2016 – 2018 [El debate sobre los cultivos transgénicos en Sudamérica y su cobertura en los diarios Clarín Y Folha de S. Paulo de 2016 a 2018]. *Brazilian Journalism Research*, 16(2), 264-291. doi: 10.25200/BJR.v16n2.2020.1255. Review.

Elba Díaz Cerveró

SNI Nivel I

JOURNALISTIC COVERAGE OF ORGANIZED CRIME IN MEXICO: REPORTING ON THE FACTS, SECURITY PROTOCOLS, AND

RECURRENT SUBTHEMES

ABSTRACT. Mexico is among the most violent countries for journalism, with more than 100 journalists killed in the past two decades. Behind these murders, which have largely gone unpunished, are phenomena such as organized crime and corruption, as well as a lack of state presence in some regions. In this study, we focus on analysis of a relevant topic in the contemporary news agenda, namely journalistic coverage of organized crime. For this, we interviewed almost two dozen Mexican journalists

who work in Mexico's main media outlets. Through journalists' responses, we observe the normalization of violence in their everyday work. Although the journalists interviewed recognize that they do not have, in general, specific knowledge of this type of coverage, their experience directs them to develop security protocols, including use of their media outlets' physical infrastructure and strategic use of social networks and the Internet.

Díaz-Cerveró, E., Ibáñez, D. B. (2020). Journalistic coverage of organized crime in Mexico: Reporting on the facts, security protocols, and recurrent subthemes. *International Journal of Communication*, 14, 2500-2518. Article.

María Elena Gutiérrez Rentería

Investigador Titular B, Profesor investigador

LATIN AMERICA

ABSTRACT. Researching media economics and media management in Latin America is not an easy challenge. The study of applied media economics and media management in the region is still in a nascent stage and only about to be consolidated. Most academics who analyze the industry are based at private universities with comparatively limited resources. This chapter describes the studies on media economics and media management in the region. Otherwise, this work presents the support that academics Albarran, from North Texas University, in the USA, and Nieto, from Universidad de Navarra, in Spain, have provided to different Latin American authors for the development of this line of research. Finally, this section gives, also, an overview of the contributions of Latin American researchers in the field of media economics and media management in the region.

Gutiérrez-Rentería, M. E. (2020). Latin America. In Bjørn von Rimscha (ed.), *Management and Economics of Communication* (pp. 365-373). Berlin, Germany: De Gruyter. doi: 10.1515/9783110589542-019. Book Chapter.

María Elena Gutiérrez Rentería

Investigador Titular B, Profesor investigador

SOCIAL AND ETHICAL ASPECTS OF MEDIA ECONOMICS RESEARCH

ABSTRACT. This work aims to contribute to research on media economics with a holistic vision, as suggested by Albarran (2017) and Godoy (2016), considering the importance of the ethical and social aspects in the media economy. The structure of the chapter is divided into four parts. Part one deals with the concept of the media firm according to the current digital environment of the industry. The second part deals with the role of ethics in media economy. The third part shows

the media company links with the ethical aspects, while the final section includes the social aspects that have strong influence in the media economy in the 21st century. Finally, a research agenda is presented.

Gutiérrez-Rentería, M. E. (2019). Social and ethical aspects of media economics research. In A. B. Albarran (ed.), *A Research Agenda for Media Economics* (pp. 159-172). Cheltenham, UK: Edward Elgar Publishing Limited. doi: 10.4337/9781788119061.00015. Book Chapter.

Mariano Emmanuel Navarro Arroyo

Investigador Titular A, SNI Nivel C

EARLY SURVEYS IN LATIN AMERICA AND TRANSNATIONAL COMMUNICATION RESEARCH, 1941-1945: CANTRIL'S DISCONTINUED LEGACY IN THE AMERICAS

ABSTRACT. This article examines the history of survey and communication research in Latin America. Aiming to contribute to a more robust transnational history of communication research in the American continent we examine the works of Nelson Rockefeller's OIAA (Office of Inter-American Affairs) and Hadley Cantril in several Latin American countries. We argue that, despite the importance of these early studies, they are not considered in the official history of communication because they failed to leave institutional traces in Latin America and also due to the fact that transnational archival work has only seldom been considered an important source in Latin American history of communication.

Navarro M. & Ortiz Garza J. L. (2019). Early Surveys in Latin America and Transnational Communication Research, 1941-1945: Cantril's Discontinued Legacy in the Americas. *Media History*, 26(3), 301-315. doi: 10.1080/13688804.2019.1585236. Article.

María Teresa Nicolás Gavilán

SNI Nivel I

María de los Ángeles Padilla Lavín

Profesor investigador

SOFTS SKILLS DEVELOPMENT FOR PROFESSOR AND Z GEN STUDENTS AT UNIVERSIDAD PANAMERICANA (MEXICO)

ABSTRACT. There are new challenges in our universities with the arrival of Z Generation students. In Mexico, there are more than 33 million young men and women borned since 1995, and they have grown up in a digital environment, used to living their lives with a great variety of technological devices and gadgets. These challenges are emerging, now that they are in university classrooms, for teachers, as well as directives, that belong to prior generations like Baby Boomers, X Generation or Millennials. They have to adjust their

teaching-learning process and methods, as well as the new young students. These young students show great curiosity and a utilitarian vision, that most of the times will be fulfilled with a Google search, a tutorial or social media; they look at university education, as a tool, which will allow them to enter into a job market with better possibilities. In order to incorporate these two big areas, that seem to go in opposite directions, two research studies were made in Universidad Panamericana. In the first one, participated more than 500 professors in our three campus, using quantitative and qualitative techniques, and the data obtained showed the needs, that the academics have to improve their experience with students in classrooms. In the other hand, more than 900 new students in the 2018-2022 cycle, participated in a survey about life style and learning methods. These allowed us to know their habits and studying techniques, and their expectations about university life. It showed opportunity areas to work soft skills, in parallel with their study programs in their university career. The data obtained in both of the studies was statistically analyzed using SPSS. The results are being used to evaluate and develop new courses and improving existing ones, offered by CIE, Educational innovation Center that focus in the formation of professors and SMART CENTER, a space designed to improve abilities and ideas through courses, seminars and international meetings, in order to create a more gratifying and satisfactory experience. Not only talking about hard skills, but with soft skills that will help them have a better professional development. ©2019 IATED Academy.

Nicolás-Gavilán, M. T. & Padilla-Lavín, M. (2019). Softs skills development for professor and Z gen students at Universidad Panamericana (Mexico). *INTED2019 Proceedings*. 13th International Technology, Education and Development Conference (Spain), Valencia (pp. 7173-7183). doi: 10.21125/inted.2019.1736. Conference Paper.

María Teresa Nicolás Gavilán

SNI Nivel I

TRANSMEDIA NARRATIVES AND LITERACIES: THE CASE OF CHILDREN IN MEXICO CITY

ABSTRACT. The purpose of this study is to explore the recurrent narratives children select from their media environment. For most elementary school students, content exposure in digital media is a voluntary act, where they intentionally choose a certain type of content within the immense flow of communication messages circulating in all kinds of platforms and devices that make up what we call the media environment. Hence, from the Users and Gratifications premise that considers the child an active user of the media, the present article emphasizes the interconnectedness of modern media of communication and the narratives that emerged after analyzing children's choices. Findings show four central narratives

that indicate a transmedia storytelling phenomenon in the lives of children. The final discussion examines the implications of this for formal education. ©2019 International Academy of Technology, Education and Development (IATED).

Baptista-Lucio, M. P., Nicolas-Gavilán, M. T., & Fernández Collado, C. (2019). Transmedia narratives and literacies: the case of children in Mexico City. *ICERI2019 Proceedings*. 12th annual International Conference of Education, Research and Innovation (Spain), Seville (pp. 1529-1538). doi: 10.21125/iceri.2019.0442. Conference Paper.

María Fernanda Vidal Correa

SNI Nivel I

MEDIA COVERAGE OF CAMPAIGNS: A MULTILEVEL STUDY OF MEXICAN WOMEN RUNNING FOR OFFICE

ABSTRACT. Previous studies on the United States and Latin America have demonstrated unequal media coverage of men and women during electoral campaigns. However, in Mexico, a country where women increasingly participate in politics, this has seldom been studied. This is worrisome when considering that, with gender stereotyping, the media can create new barriers for female candidates, affecting voters' perceptions of women's expertise and policy proposals. Through a comparative analysis, this research explores the role of the media when covering women running for office. It specifically studies coverage of executive-branch campaigns at the three levels of government. This is an important contribution to the literature as there are few studies of the Mexican context; specifically, this research examines the visibility, focus, traits, and issues covered in written media in order to explore, as well expand knowledge of, media biases and Mexican politics. Findings suggest that women running for positions with more power received different appraisal in printed media. Furthermore, male candidates received more coverage with the number of stories and headlines explicitly covering them higher than female candidates. This was most evident in municipal elections. At the same time, coverage of both female and male candidates shied away from personal traits or family matters. The media's attention was on 'male' issues, where women were less competitive than men. Albeit with marginal differences, coverage of municipal elections was positive for women (where they won), compared with that of the across-the-board losses for female candidates running for governor.

Vidal-Correa, F. (2020). Media coverage of campaigns: A multilevel study of Mexican women running for office. *Communication and Society*, 33(3), 167-186. doi: 10.15581/003.33.3.167-186. Article.

María Fernanda Vidal Correa

SNI Nivel I

MEDIA COVERAGE OF WOMEN IN POLITICS: MEXICAN LOCAL POLITICIANS ON CAMPAIGN

ABSTRACT. Press coverage of women was expected to increase with their greater political representation in Mexico. What characterises the coverage that print media has given to men and women running for office? Are there any differences in the coverage men and women received? Is the quality of this coverage better than the quantity? The media coverage of candidates running in Mexican local elections is analysed in this exploratory study in order to answer these questions. Attention is first given to visibility, as in the quantity of coverage received. Second, the type of coverage of men compared to women is studied. Third, the paper looks into the ways in which printed media covers stories about women and the issues highlighted in the stories. The findings were mixed. In general, female and male candidates are equally visible. Newspaper coverage does not vary in tone, however, male candidates focus only on 'female' issues when more women stand for election.

Vidal-Correa, F. (2020). Media coverage of women in politics: Mexican local politicians on campaign. *Journal of International Communication*, 26(1), 1-19. doi: 10.1080/13216597.2020.1736599. Article.

María Fernanda Vidal Correa

SNI Nivel I

PRESIDENTIAL ELECTIONS IN MEXICO: MEDIA COVERAGE OF THE JOSEFINA VAZQUEZ MOTA CAMPAIGN

ABSTRACT. In 2012, the incumbent party nominated the first woman with a real chance of being elected president in Mexico. This was an historic moment, later described as a "haughtily hen" looking for a chance to win. The present study analyzed whether media coverage —by paying more attention to the candidate's family and appearance, rather than policy issues— created opportunities for sexism and gendered stereotyping. The findings of this analysis were mixed. Male candidates received more media coverage, as the number of stories and headlines that covered them was higher. In contrast, coverage of the female candidate focused on stories about her polling position, highlighting her struggle to reach second place and the low probability of being elected. Nevertheless, coverage of personal traits was minimal. Moreover, only the female candidate (in her appeal to the electorate) made specific references to her sex.

Vidal Correa, F. (2020). Presidential Elections in Mexico: Media Coverage of the Josefina Vazquez Mota Campaign. *Women's Studies*, 1-18. doi: 10.1080/00497878.2020.1772791. Article.

**ESCUELA DE
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⁵ Colaboración en un artículo publicado en Facultad de Ingeniería (p. 118).

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Investigador Titular D, SNI Nivel I

EVALUATING THE IMPACT OF ORDER PICKING STRATEGIES ON THE ORDER FULFILMENT TIME: A SIMULATION STUDY

ABSTRACT. The methodology of the study was qualitative in order to understand and describe the experiences of undergraduate students attending the i-Lab camp. Data came from a questionnaire with open-ended questions sent to the students participants. In addition, individual interviews with the students were conducted.

Preliminary findings focus on how entrepreneurship influenced the development of undergraduate students. They strengthened some skills such as teamwork, synthesis, analysis, self directed learning, leadership, negotiation, empathy, and critical thinking. Students described their experiences in i-Lab as very challenging but rewarding. In addition to hard work and the sacrifices they had to make in order for their projects to come through, they shared the importance of living the methodology, their personal growth, and how the experience enhanced their decision-making skills.

Alongside this results, the findings provides insights to move to a student centered model. Higher Education Institutions need to include experiential learning projects and partner with different centers inside and outside the university to reshape the curricula and provide different learning experiences.

Urzúa, M., Mendoza, A., & González, A. O. (2019). Evaluating the impact of order picking strategies on the order fulfilment time: A simulation study. *Acta Logistica*, 6(4), 103-114. doi: 10.22306/al.v6i4.129. Article.



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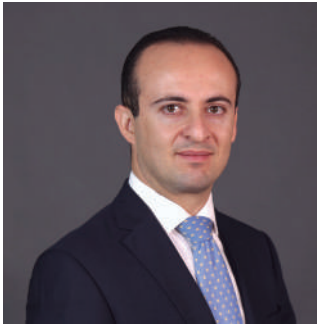
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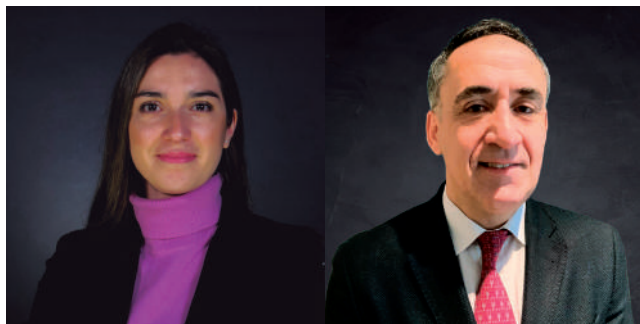
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VALUES AND RESILIENCE OF MEXICO CITY: A WORKSHOP DESIGNED WITH AN ETHICAL APPROACH TO CHANGE THE PERCEPTION OF UNIVERSIDAD PANAMERICANA'S CAMPUS COMMUNITY TO DEAL WITH NATURAL DISASTERS

ABSTRACT. In 1985 Mexico City was struck by an earthquake of 8.1 magnitude on the Richter scale causing major disasters. After this, Mexican population received training to evacuate in case of earthquake. Evacuation drills were held every year in all institutions throughout the city. In 2017 Mexico City was hit again by two strong earthquakes. The one on September 19, with a magnitude of 7.1 on the Richter scale, left the city with a balance of 370 deaths, 30000 people affected and more than 11000 buildings damaged. Hence, it was concluded that although the population received technical trainings to face natural disasters this was not enough.

The Universidad Panamericana (UP) pedagogical research team (SMART Center and CIE), in close cooperation with the UP Engineering School, and the World Resources Institute (WRI) Mexico, worked together designing an innovative experience to:

Raise awareness about both the Earth's and Mexico City's fragility.

Give an integral vision of urban resilience.

Present the ethical dimension of urban resilience.

Generate proposals from UP campus community to reinforce the values required to contribute to urban resilience before, during and after the disaster.

To achieve these goals and guide the introduction of new concepts, reflect on them, allow an active involvement and interaction among participants, a workshop format was chosen. To activate social relationship dynamics, to foster open attitudes and to stimulate a problem solving approach, three pedagogical principles were followed: interdisciplinarity, collaboration, and activeness.

The workshop "Values and Resilience of Mexico City" sought to be a place for dialogue and ideation to obtain proposals from Universidad Panamericana's campus community in order to reinforce the values that are required to contribute to urban resilience, aligned with the educational philosophy of the university: ethical and social responsibility to face emergencies arising from natural disasters.

124 people from 7 different fields of study participated. After the event the perception of knowl-

edge and capability of the participants to contribute in a disaster from an ethical perspective increased in 44%. The experience was positively received and sparked a special enthusiasm among participants since they discovered the importance of the ethical component when facing any disaster.

This paper will present the educational actions and pedagogical strategies used in the workshop in order for anyone to replicate it.

Mendieta, B.; Armesto, G. M.; Repellin, A. A. (2020), "VALUES AND RESILIENCE OF MEXICO CITY: A WORKSHOP DESIGNED WITH AN ETHICAL APPROACH TO CHANGE THE PERCEPTION OF UNIVERSIDAD PANAMERICANA'S CAMPUS COMMUNITY TO DEAL WITH NATURAL DISASTERS", *14th International Technology, Education and Development Conference (INTED2020 Proceedings)*: 1309-1314. doi: 10.21125/inted.2020.0442. Conference Paper.

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HOW TO GENERATE A MOTIVATIVE, EFFECTIVE, TRUSTING, INNOVATIVE AND CREATIVE WORK ENVIRONMENT THAT FOSTERS THE CREATION OF INNOVATIVE EDUCATIONAL EXPERIENCES: SMART CENTER IDEATION

ABSTRACT. Nowadays, education institutions seek to innovate their methodologies to enhance their learning processes to be more effective. To achieve this, it is fundamental for the people who create educational experiences to build a high-performance work team. For this, working in atmospheres that foster motivation, effectiveness, creativity, innovation, and trust is vital. Project managers play a central role in setting the work environment that generates a high-performance work team. A high-performance work team is "a group of goal-focused individuals with [...] complementary skills who collaborate, innovate and produce a consistently superior result (SHRM, 2019)".

This paper presents the project management process that SMART CENTER, a student center at Universidad Panamericana, followed to achieve an innovative, effective and highly engaging experience called SMART Room for more than 100 students in a time frame of 5 weeks and a team of only 10 people. This article will cover each step taken for the ideation, organization, planning, and execution of the SMART Room and will explain the basic principles so that anyone can replicate it in their teams and projects.

Armesto, G. M., Repellin, A. A., & Nicolas-Gavilan, M. T. (2020). How to Generate a Motivative, Effective, Trusting, Innovative and Creative Work Environment That Fosters The Creation of Innovative Educational Experiences: Smart Center Ideation. *INTED2020 Proceedings. 14th International Technology, Education and Development Conference (Spain), Valencia* (pp. 4302-4309). doi: 10.21125/inted.2020.1195. Conference Paper.

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SAMPLING BIAS AND ITS IMPLICATIONS IN THE EVALUATION OF THE POPULATION WITH GENETIC RISK FOR SCHIZOPHRENIA

[SESGO DE MUESTREO Y SUS IMPLICACIONES EN LA EVALUACIÓN A PERSONAS CON RIESGO GENÉTICO DE PADECER ESQUIZOFRENIA]

ABSTRACT. Schizophrenia is considered a heterogeneous mental disorder that encompasses wide ranges of perceptual, cognitive, emotional, functional, structural, and behavioural expressions, which is also associated with significant genetic susceptibility. For this reason, research on this disease involves carefully selecting the study population to perform an adequate analysis and generalisation of the results. This paper proposes to present and discuss various sampling biases based on empirical evidence that mainly result from the indiscriminate and widespread inclusion of at-risk individuals and patients with schizophrenia and/or related disorders, and at the same time trying to propose more stringent sample selection criteria that guarantee reliable results. Consequently, particularly focus is made on the relationship between patients with schizophrenia and their first-degree relatives, due to their genetic similarity and the advantages it offers to evaluate various environmental factors linked to the onset of the disease.

Brofman-Epelbaum, J. J., González-Garrido, A. A., & Gómez-Velázquez, F. R. (2020). Sampling bias and its implications in the evaluation of the population with genetic risk for schizophrenia [Sesgo de muestreo y sus implicaciones en la evaluación a personas con riesgo genético de padecer esquizofrenia]. *Psiquiatría Biológica*, 27(1), 34-39. doi: 10.1016/j.psiq.2020.01.006. Review.

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TIME PERSPECTIVE, LEARNING PATTERNS AND ACADEMIC ACHIEVEMENT IN MEXICAN UNIVERSITY STUDENTS

[PERSPECTIVA DE FUTURO, PATRONES DE APRENDIZAJE Y RENDIMIENTO ACADÉMICO EN ESTUDIANTES UNIVERSITARIOS MEXICANOS]

ABSTRACT. The purpose of this study was to analyze the relationship between future perspective, the adoption of different learning patterns, and academic performance of university students. Participants were 175 students, average age 20, who responded to the Time Perspective Inventory (ZTPI) and the Inventory of Learning Styles (ILS). Results show that learning patterns play a mediating role between future perspectives and academic performance. We suggest the promotion of more equitable teaching contexts that affect the adoption of learning patterns aimed at understanding of meanings.

Gaeta González M. L., Jiménez M. E., Reyes Vergara M. L., Gutiérrez Niebla, M. I., González Rabino, M. L., Benítez Ríos, Y. T., & García-Béjar, L. (2020). Time perspective, learning patterns and academic achievement in Mexican University students [Perspectiva de futuro, patrones de aprendizaje y rendimiento académico en estudiantes universitarios mexicanos]. *Estudios Sobre Educación* 39(1), 9-31. doi: 10.15581/004.39.9-31. Review.

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COMPETENCIES AND SOFT SKILLS DEVELOPMENT BY INTEGRAL PROJECTS AT UNIVERSIDAD PANAMERICANA (MEXICO)

ABSTRACT. When students only attend a class inside a classroom to listen to a professor, they do not have enough opportunities to develop all the hard and soft skills needed for excellent performance on their personal and professional lives (Quieng,

et al. 2015). They may have a significant amount of information. However, they are not able to transfer their main learnings to real-life situations, solve different kinds of problems, work collaboratively, make appropriate decisions, and many other essential outcomes needed for nowadays society (Brown et al. 2017).

Because of these, the Pedagogy School of Universidad Panamericana Campus Aguascalientes, since August 2016, has been designed and applied a method that is helping for the best development and learning performance of the students: Integral Projects. Based on the PBL method (Savery, 2015) and by a design thinking chart (Koh et al. 2015), it has been achieved the integration of each of the subjects in a complete intervention process in a real-life context attending a specific problem in different areas of their profession.

By these, students can develop different professional experiences, networking with professionals of different areas and also, the collaboration between students, professors, and external authorities. That lets them have more and better employment opportunities, better academic approaches, and higher personal mastery

In order to determine the effectiveness of this method, a research study was developed in the University, in which 80 students and 30 teachers of the School of Pedagogy participated, answering an instrument with quantitative and qualitative items related to three dimensions. There are: (a) learning achievement due to integral projects method, (b) organization and management of the projects, and (c) personal thinking about the method.

The collected data were analyzed with SPSS and AtlasTi. The results showed exciting findings such as the fact that these projects help to develop professional competence and soft skills in students, and in the other hand, that factors related to organization and communication between authorities of the School, teachers, and students, represent weaknesses that should be attended to improve.

The results are being used to redesign the pedagogy model of the School. The new Learning Outcome model of the University fosters the use of active methodologies. These methodologies are considered as essential tools to achieve de graduated profile. Also, new strategies for teacher training are being developed, such as the Educational Innovation Master that will help professors to acquire new teaching competencies.

Fernandez-de-Castro, J., Flores-Munguia, M. & Nicolas-Gavilan, M. T. (2020). Competencies and Soft Skills Development by Integral Projects at Universidad Panamericana (Mexico). *INTED2020 Proceedings*. 14th International Technology, Education and Development Conference (Spain), Valencia (pp. 7145-7153). doi: 10.21125/inted.2020.1890. Conference Paper.

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CURRICULUM INNOVATION FOR ACHIEVING HIGHER QUALITY ON THE EXPECTED LEARNING BY A NEW PEDAGOGICAL MODEL UNIVERSIDAD PANAMERICANA (MEXICO)

ABSTRACT. The School of Pedagogy of Universidad Panamericana Campus Aguascalientes has been studying the pertinence and quality of their programs and especially, the Pedagogical model that allows or limits students to learn and develop what they should, to achieve their personal and professional goals (Nicholls, A. 2018).

Since 2018 there has been an investigation with students, graduate students, professors, and employers to know if they think the school and its academic programs are helping on the integral development of its students. We found the vital necessity of actualizing our Pedagogy career program: the subjects for each professional area and semester, contents, disciplinary learning outcomes, etc.; but also, the Pedagogical model of the School to achieve the Learning outcomes of the Pedagogy career, the Learning outcomes of each of the subjects, all the needed elements for a complete and pertinent graduation profile for all of the students, the didactic situations and methods, and of course, a new way to assess students performance (Mintz, K., & Tal, T. 2018).

The objective of this work is to present a qualitative research study about the developed process to design two crucial educational elements: (a) the new pedagogical model of the School of Pedagogy, its characteristics, didactic elements, pedagogical processes, the review and feedback provided by international and national experts in Curriculum design (Romiszowski, A. J. (2016) and educational innovation (Koh, et al. 2015) and (b) the used technique to update the Pedagogy career program curriculum regarding the new School Pedagogical Model. Five teachers who participated in the process were interviewed in-depth, explaining their thoughts, experiences, and contributions.

The results show how the new Pedagogical Model was achieved based on the belief that the student is the most important agent of the learning process. Students need to have enough engagement and commitment with his process, that this process needs to have a close relationship with the contexts and professional fields and, on the other hand, the professor should guide and design the correspon-

ding didactic situations (active methodologies) that may propitiate different kinds of learning experiences. The new model is based on Project-based learning (PBL), dual education, flipped classroom divided into personal work, and standard classes where the professor can share main content, define the socialization needed to increase, and assess the learning process, and results of each student.

Flores-Munguia, M., Fernandez-de-Castro, J., & Nicolas-Gavilan, M. T. (2020). Curriculum Innovation For Achieving Higher Quality On The Expected Learning By A New Pedagogical Model Universidad Panamericana (Mexico). *INTED2020 Proceedings*. 14th International Technology, Education and Development Conference (Spain), Valencia (pp. 7185-7193). doi: 10.21125/inted.2020.1897. Conference Paper.

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CIBERACOSO DESDE LA PERSPECTIVA DOCENTE DISCURSOS, PERCEPCIONES Y ESTRATEGIAS DE PROFESORES EN DOS CIUDADES DE CHILE Y MÉXICO

ABSTRACT. Despite rising figures on use of the internet and social networks in Latin America, and on the prevalence of cyberbullying, there is scant knowledge of the reality teachers in the region face. Through a qualitative approach, this investigation explores discourses and experiences of teachers in Chile and Mexico, in the cities of Santiago and Guadalajara, related to this issue, and the tools they use to cope with such situations. For this purpose, we conducted in-depth interviews with 57 teachers at schools classified at low, middle, and high socio-economic level, who are responsible for students between 12 and 17 years of age. The main results indicate that teachers' confidence in identifying cyberbullying increases when they themselves are users of social networks, that their preparation to prevent it and intervene is crucial, and that institutions need to make the issue a priority because it is a growing phenomenon which remains largely unexplored by teachers.

Pavez, I., García-Béjar, L. (2020). Ciberacoso desde la perspectiva docente Discursos, percepciones y estrategias de profesores en dos ciudades de Chile y México. *Perfiles Educativos*, 42(168), 28-41. doi: 10.22201/ISSUE.24486167E.2020.168.58850. Article.

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A PIONEERING MEDIEVAL DISCUSSION OF MEDICAL ETHICS: THE QUAESTIO AN SIT LICITUM PROVOCARE ABORSUM BY GENTILE DA FOLIGNO

[UNA DISCUSIÓN MEDIEVAL PIONERA DE LA ÉTICA MÉDICA: LA QUAESTIO AN SIT LICITUM PROVOCARE ABORSUM, DE GENTILE DA FOLIGNO]

ABSTRACT. The issue on the moral lawfulness of therapeutic abortion was well discussed during the Middle Ages. One of the first physicians to bring up the debate from the point of view of clinics and professional ethics was Gentile da Foligno (1272-1348), a physician and investigator from Perugia, who in the *Quaestio an sit licitum provocare aborsum* (ca. 1340) explained the conditions by which it is or not lawful to cause an abortion as a therapeutic measure. The *Quaestio* is divided into three parts: the first one explains what abortion is, the second explains the issue in a practical way: when or not to turn to therapeutic abortion, it also mentions some classical and contemporary authorities. On the third section the author gives his own opinion and solves the issue according to two criteria: the completeness of the fetus and the therapeutic utility of abortion for the mother's life.

Nares G. G. (2020). Una discusión medieval pionera de la ética médica: La *Quaestio an sit licitum provocare aborsum*, de Gentile da Foligno. *Open Insight*, 11(23), 182-196. Article.

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EVERYTHING IS CONNECTED: EXPLORING PATHWAYS TOWARDS ENVIRONMENTAL AWARENESS WITHIN UNIVERSIDAD PANAMERICANA'S COMMUNITY THROUGH A LEARNING BY DESIGN, ACTIVE AND MULTIDISCIPLINARY EXPERIENCE

ABSTRACT. Everything is strongly connected, we are faced not with two separate crises, one environmental and the other social, but rather with one complex crisis which is both social and environmental (Francis, 2015).

The encyclical *Laudato Si'* by Pope Francis proposes the analysis of environmental problems without separating them from the analysis of

human, family, professional and urban contexts; it is a call to conversion and action for the care of our "common home".

As a member of the Inter-American Chair Laudato Si', the Universidad Panamericana assumed the commitment to socialize and discuss the Encyclical within its campus community, in order to analyze and extract the fundamental principles that should be incorporated in its three substantive functions.

Socializing an encyclical letter through an active, interactive, and innovative experience that encourages the commitment of the campus community towards ecological conversion was the objective with which we designed the Workshop Laudato Si'. It was structured in four sections, each leading the participants to envision the "common home", understand the call to its care, propose and develop paths towards "ecological conversion", and assume the commitment of caring for the "common home".

161 representatives from 26 schools and departments voluntarily participated. The experience was well received throughout its four stages. They evaluated the workshop both in quantitative and qualitative aspects, and stated that working with the contents of the encyclical letter through an active learning and multidisciplinary experience helped them visualize the Pope's call to action in a more creative, practical and integral perspective.

Another element that outstands in the workshop's methodology is the interaction between representatives of all sectors of the campus community to generate proposals. This allowed the development of soft skills such as design, systemic, creative and collaborative thinking, problem solving and teamwork. In addition, the workshop's experience led to the creation of a sense of community and the assumption of several commitments seeking planetary sustainability.

This paper describes our experience developing an innovative education methodology for the socialization of sustainability issues with the aim of sharing good practices and making them replicable in various educational contexts at different levels.

Mendieta, B.; Repellin, A.; Chavez, R. (2018), "EVERYTHING IS CONNECTED: EXPLORING PATHWAYS TOWARDS ENVIRONMENTAL AWARENESS WITHIN UNIVERSIDAD PANAMERICANA'S COMMUNITY THROUGH A LEARNING BY DESIGN, ACTIVE AND MULTIDISCIPLINARY EXPERIENCE", *11th annual International Conference of Education, Research and Innovation (ICERI2018 Proceedings)*: 1168-1176. doi: 10.21125/iceri.2018.1267. Conference Paper.

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INCREASING UNIVERSITY STUDENTS ENGAGEMENT: A GUIDE ON HOW TO ACHIEVE IT IN EXTRACURRICULAR NON-MANDATORY ACADEMIC EXPERIENCES BASED ON SUCCESS CENTER KNOW HOW

ABSTRACT. Since Success Center creation in September 2017, 1,042 students have participated in the center academic experiences. This represents approximately 25% of the University population. The participation of the students is undoubtedly due to the strategies implemented by the center to generate engagement with students.

The meaning of student engagement varies from author to author. For this article, we will define student engagement as the degree of involvement, interest, motivation, and attention that students display in their learning process and how connected they are with: 1) the university environment, 2) the university activities, 3) their peers, teachers and the academic staff.

For Hobsons, (2019) there are three types of engagement: "Academic engagement refers to how students react to their classwork, lessons, homework, testing, and the hands-on learning that occurs in a school environment. Social engagement contains any participatory activities that happen in school, such as friendships with other students, clubs and activities, special events, or sports. Emotional engagement refers to the personal relationships that students make with adults in their school community (p.6)"

This paper presents how Success Center, an academic center for students in Universidad Panamericana, has increased university students' engagement in extracurricular non-mandatory academic experiences. To attract students' attention, involvement, interest, and motivation it is necessary to take into account and to implement strategies in the three types of engagement exposed above. This article will cover the basic principles to do this, will show specific successful examples, and a guide for anyone that wants to implement this practice in their learning environment.

Repellin, A. A., Armesto, G. M., & Rojano, R. (2020). Increasing University Students Engagement: A Guide On How To Achieve It In Extracurricular Non-Mandatory Academic Experiences Based On Success Center Know How. *INTED2020 Proceedings. 14th International Technology, Education and Development Conference (Spain), Valencia* (pp. 2968-2973). doi: 10.21125/inted.2020.0880. Conference Paper.

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ORGANIZING YOUR LIFE LIKE A BOSS: AN ONLINE EXPERIENCE FOR THE ENHANCEMENT OF EFFECTIVE TIME MANAGEMENT STRATEGIES

ABSTRACT. Nowadays, the scarcest resource is not money as traditional economic analysis suggests, but time. Among the main diseases of our society are those related to stress and anxiety, especially in young people. The emotional, affective, and social consequences of the lack of time to attend all areas of interest appear constantly in the media. People are increasingly required to do more and more activities hence, feeling overwhelmed as they cannot face them all (Villa & Poblete, 2007).

During the launch of the Success Center, a campaign was organized on campus to identify the main needs perceived by the students of Universidad Panamericana. These results helped us develop services of interest for them. 909 students participated in the campaign; the main detected need was time management, requested by 28.4 % of the students. On the other hand, the University advisers also detected time management as one of the most desired skills among students. Therefore, Organizing your life like a boss was created.

In order to design this experience, the context of university students was analyzed: young people are facing changes in the way they obtain information; their reality is closely linked to digital networks, which is reflected in their globalized tastes and preferences, easier access to data, superior domain of information technology (IT), use of English as a common language, choice of audiovisual stimuli over written ones and real-time long-distance interactions (Rubio Gil, 2010). This influences their way of processing information, their understanding of reality and their way of approaching the world; which generates the need to redefine learning environments to more interactive, fast-paced and efficient ones.

Organizing your life like a boss is an online course that allows students to detect how they

manage their time and learn strategies to increase their productivity. The structure of the course lets students decide when, how, and where they want to do it. This guarantees that the students can start at their own level of knowledge, control their learning pace, and build their own experience. 136 students from Universidad Panamericana were enrolled in the course and the average satisfaction rate was 9.3 on a scale of 1-10, with 1 being the lowest grade and 10 being the highest. This paper presents the basic principles for the creation of this educational experience.

Repellin, A. & Armesto, G. (2018). Organizing Your Life Like A Boss: An Online Experience for The Enhancement of Effective Time Management Strategies. *ICERI2018 Proceedings*. 11th annual International Conference of Education, Research and Innovation (Spain), Sevilla (pp. 1134-1141). doi: 10.21125/iceri.2018.1262. Conference Paper.

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NOTES ON THE FORMATION OF CONSCIENCE IN JOHN HENRY NEWMAN

[NOTAS SOBRE LA FORMACIÓN DE LA CONCIENCIA EN JOHN HENRY NEWMAN]

ABSTRACT. This article tries to show the relevance of John Henry Newman's approach regarding with the formation of conscience. Accordingly, some of his most relevant ideas are taken from his most representative texts, as well as from those of his commentators and critics of his Thought. These are contrasted with some classical and current perspectives about this subject. The aim of the text is to prove how Newman, with his ideas on the Moral Sense, the Sense of Duty and the Illative Sense, among others, offers reflections of great value that can be applied in a practical way to this issue of the Christian Formation. © 2019 Servicio de Publicaciones de la Universidad de Navarra. All rights reserved.

Rumayor, M. (2019). Notes on the formation of conscience in John Henry Newman [Notas sobre la formación de la conciencia en John Henry Newman]. *Scripta Theologica* 51(3), 801-853. doi: 10.15581/006.51.3.801-823. Review.

The image shows the front cover of a book. The background is a light brown color with a repeating geometric pattern of interconnected triangles and polygons. In the center, there is a white rectangular box with a thin black border. Inside this box, the title of the book is written in a bold, black, sans-serif font, arranged in four lines. Below the white box, there is a dark brown, solid-colored area that forms a wide base for the cover. The overall design is clean and modern.

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BRAIN-INSPIRED HEALTHCARE SMART SYSTEM BASED ON PERCEPTION-ACTION CYCLE

ABSTRACT. This work presents the HSS-Cognitive project, which is a Healthcare Smart System that can be applied in measuring the efficiency of any therapy where neuronal interaction gives a trace whether the therapy is efficient or not, using mathematical tools. The artificial intelligence of the project underlies in the understanding of brain signals or Electroencephalogram (EEG) by means of the determination of the Power Spectral Density (PSD) over all the EEG bands in order to estimate how efficient was a therapy. Our project HSS-Cognitive was applied, recording the EEG signals from two patients treated for 8 min in a dolphin tank, measuring their activity in five experiments and for 6 min measuring their activity in a pool without dolphin in four experiments. After applying our TEA (Therapeutic Efficiency Assessment) metric for patient 1, we found that this patient had gone from having relaxation states regardless of the dolphin to attention states when the dolphin was presented. For patient 2, we found that he had maintained attention states regardless of the dolphin, that is, the DAT (Dolphin Assisted Therapy) did not have a significant effect in this patient, perhaps because he had a surgery last year in order to remove a tumor, having impact on the DAT effectiveness. However, patient 2 presented the best efficiency when doing physical therapy led by a therapist in a pool without dolphins around him. According to our findings, we concluded that our Brain-Inspired Healthcare Smart System can be considered a reliable tool for measuring the efficiency of a dolphin-assisted therapy and not only for therapist or medical doctors but also for researchers in neurosciences. © 2020 by the authors.

Escobar, J. J. M., Matamoros, O. M., Padilla, R. T., Reyes, I. L., Hernández, L. C., & Ramírez Gutiérrez, A. G. (2020). Brain-inspired healthcare smart system based on perception-action cycle. *Applied Sciences* (Switzerland), 10(1), 264-291. doi: 10.3390/app10103532. Article.

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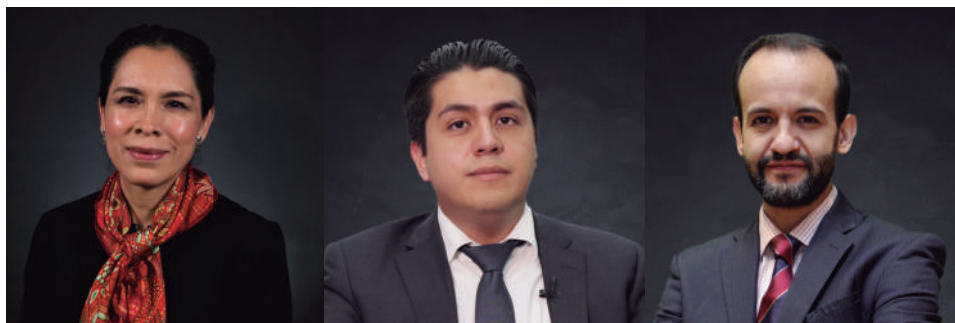


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⁸ Colaboración en dos artículos publicados en Facultad de Ingeniería (pp. 122, 147).

⁹ Colaboración en un artículo publicado en Facultad de Ingeniería (pp. 122).



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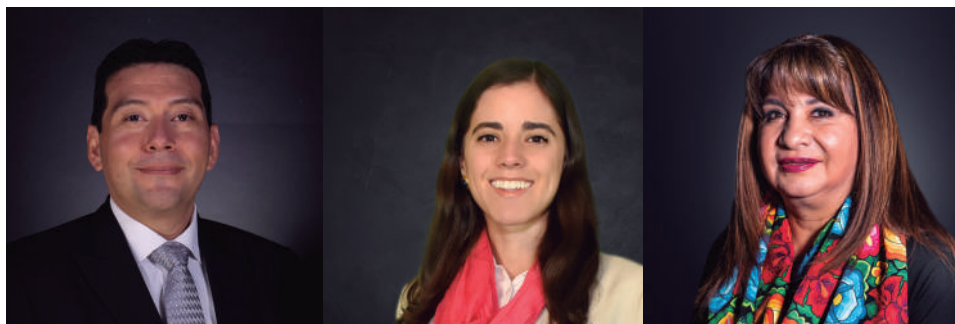
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Evandro Agazzi

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FREEDOM VERSUS REGULATION IN SCIENCE AND TECHNOLOGY

ABSTRACT. Almost half a century ago a strong controversy opposed the philosophers advocating an unrestricted freedom of science to those advocating a moral and legal regulation of science, that dispute did not produce significant results because it rested on a lack of distinction (that does not mean separation) between science and technology. The defining aim of science is acquisition of knowledge and that of technology is production of objects and performances. Humans have always developed a large display of techniques for the realization of different activities and technology can be defined as that special sector of technique that consists in the application of scientific knowledge. With reference to this clarification it is possible to see that pure science enjoys a substantial freedom, being ethically limited only in the case of particular means, conditions and consequences directly involved in experimental science. Applied science must be ethically evaluated also considering the goals of the application envisaged. In the case of technology ethical evaluations are much more pertinent and articulated because actions are involved and regulations are legitimate as far as they concern limitations of the freedom of action; they also can entail legal regulations. The concrete example of Medicine, that is a special technology according to the above definition, concludes the paper and it is shown that due to the fact that Medicine has to do with human persons, it is not sufficient to take into consideration its technical aspects but several other values of psychological, social and spiritual kind must contribute to the global assessment of the medical praxis in the different concrete situations. © 2020, Springer Nature B.V.

Agazzi, E. (2020). Freedom Versus Regulation in Science and Technology. *Axiomathes*, 30(6), 617-628. doi: 10.1007/s10516-020-09504-9. Article.

Francisco Javier Estrada Mena

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SNI Nivel I

ASSESSMENT OF CFH AND HTRA1 POLYMORPHISMS IN AGE-RELATED MACULAR DEGENERATION USING CLASSIC AND MACHINE-LEARNING APPROACHES

ABSTRACT. Background: CFH and HTRA1 are pivotal genes driving increased risk for age-related macular degeneration (AMD) among several populations. Here, we performed a hospital-based case-control study to evaluate the effects of three single nucleotide polymorphisms (SNPs) among Hispanics from Mexico. Materials and methods: 122 cases and 249 controls were genotyped using Taqman probes. Experienced ophthalmologists diagnosed AMD following the American Association of Ophthalmology guidelines. We studied CFH (rs1329428, rs203687) and HTRA1 (rs11200638) SNPs thoroughly by logistic regression models (assuming different modes of inheritance) and machine learning-based methods (ML). Results: HTRA1 rs11200638 is the most significant polymorphism associated with AMD in our studied population. In a multivariate regression model adjusted for clinically and statistically meaningful covariates, the A/G and A/A genotypes increased the odds of disease by a factor of 2.32 and 7.81, respectively ($P < .05$) suggesting a multiplicative effect of the polymorphic A allele. Furthermore, this observation remains statistically meaningful in the allelic, dominant, and recessive models, and ML algorithms. When stratifying by phenotype, this polymorphism was significantly associated with increased odds for geographic atrophy (GA) in a recessive mode of inheritance (12.4, $p < .05$). Conclusions: In sum, this work supports a strong association between HTRA1 genetic variants and AMD in Hispanics from Mexico, especially with GA. Moreover, ML was able to replicate the results of conventional biostatistics methods unbiasedly. © 2020 Taylor & Francis Group, LLC.

Martínez-Velazco A., Pérez-Ortiz, A. C., Antonio-Aguirre, B., Martínez-Villaseñor, L., Lira-Romero, E., Palacio-Pastrana, C., Zenteno, J. C., Ramírez, I., Zepeda-Palacio, C., Mendoza-Velásquez, C., Camacho-Ordóñez, A., Ortiz Bibriesca, D. M., & Estrada-Mena, F. J. (2020). Assessment of CFH and HTRA1 polymorphisms in age-related macular degeneration using classic and machine-learning approaches. *Ophthalmic Genetics*, 41(6), 539-547. doi: 10.1080/13816810.2020.1804945. Article.

Francisco Javier Estrada Mena

SNI Nivel I

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DEVELOPMENT OF MUSCLE ATROPHY AND LOSS OF FUNCTION IN A GULF-WAR ILLNESS MODEL: UNDERLYING MECHANISMS

ABSTRACT. Gulf War illness (GWI) afflicts military personnel who served during the Persian Gulf War and is notable for cognitive deficits, depression, muscle pain, weakness, intolerance to exercise, and fatigue. Suspect causal agents include the chemicals pyridostigmine (PB), permethrin (PM) and N,N-diethyl-m-toluamide (DEET) used as protectants against insects and nerve gases. No pre-clinical studies have explored the effects on skeletal muscle (SkM). Young male rats were provided PB, PM and DEET at equivalent human doses and physical restraint (to induce stress) for 3 weeks followed a 3-week recovery. GWI gastrocnemius weight was ~ 35% lower versus controls, which correlated with decreases in myofiber area, limb strength, and treadmill time/distance. In GWI rats, SkM fiber type relative abundance changed towards slow type I. Muscle wasting pathway proteins were upregulated while those that promote growth decreased as did mitochondrial endpoints and muscle ATP levels. Proteomic analysis of SkM also documented unique alterations in mitochondrial and metabolic pathways. Thus, exposure to GWI chemicals/stress adversely impacts key metabolic pathways leading to muscle atrophy and loss of function. These changes may account for GWI Veterans symptoms. © 2020, The Author(s).

Ramírez-Sánchez, I., Navarrete-Yañez, V., Garate-Carrillo, A., Loredó, M., Lira-Romero, E., Estrada-Mena, J., Campeau, A., Gonzalez, D., Carrillo-Terrazas, M., Moreno-Ulloa, A., Ceballos, G., & Villarreal, F. (2020). Development of muscle atrophy and loss of function in a Gulf-War illness model: underlying mechanisms. *Scientific Reports*, 10(1). doi: 10.1038/s41598-020-71486-w. Article.

Víctor Hugo Gálvez Zúñiga

SNI Nivel I

LONGITUDINAL ATROPHY CHARACTERIZATION OF CORTICAL AND SUBCORTICAL GRAY MATTER IN HUNTINGTON'S DISEASE PATIENTS

ABSTRACT. Huntington's disease (HD) is an inherited neurodegenerative disease with clinical manifestations that involve motor, cognitive and psychiatric

deficits. Cross-sectional magnetic resonance imaging (MRI) studies have described the main cortical and subcortical macrostructural atrophy of HD. However, longitudinal studies characterizing progressive atrophy are lacking. This study aimed to describe the cortical and subcortical gray matter atrophy using complementary volumetric and surface-based MRI analyses in a cohort of seventeen early HD patients in a cross-sectional and longitudinal analysis and to correlate the longitudinal volumetric atrophy with the functional decline using several clinical measures. A group of seventeen healthy individuals was included as controls. After obtaining structural MRIs, volumetric analyses were performed in 36 cortical and 7 subcortical regions of interest per hemisphere and surface-based analyses were performed in the whole cortex, caudate, putamen and thalamus. Cross-sectional cortical surface-based and volumetric analyses showed significant decreases in frontoparietal and temporo-occipital cortices, while subcortical volumetric analysis showed significant decreases in all subcortical structures except the hippocampus. The longitudinal surface-based analysis showed widespread cortical thinning with volumetric decreases in the superior frontal lobe, while a subcortical volumetric decrease occurred in the caudate, putamen and thalamus with shape deformation on the anterior, medial and dorsal side. Functional capacity and motor status decline correlated with caudate progressive atrophy, while cognitive decline correlated with left superior frontal and right paracentral progressive atrophy. These results provide new insights into progressive volumetric and surface-based morphometric atrophy of gray matter in HD.

Ramírez-García, G., Galvez, V., Díaz, R., Bayliss, L., Fernández-Ruiz, J., & Campos-Romo, A. (2019). Longitudinal atrophy characterization of cortical and subcortical gray matter in Huntington's disease patients. *European Journal of Neuroscience*, 51(8), 1827-1843. doi: 10.1111/ejn.14617. Article.

Desiderio Salomón Hernández Gutiérrez

SNI Nivel I

Víctor Manuel Arenas Luna

Profesor investigador

CUCURBITACIN IIB FROM IBERVILLEA SONORAE INDUCES APOPTOSIS AND CELL CYCLE ARREST VIA STAT3 INHIBITION

ABSTRACT. Background: Cucurbitacin IIB (CIIB) from *Ibervillea sonora* has a high capacity to suppress cancer cell proliferation and induce apoptosis. This study investigated the molecular mechanisms related to the antiproliferative and apoptosis induction capacity of CIIB in HeLa cells. Materials and Methods: The cell viability and anti-proliferative effect of CIIB were evaluated by using the trypan blue exclusion

assay. The effect of Cilb on the mitochondrial membrane potential was determined by flow cytometry using JC-1. The activity of caspase-3 and caspase-9 was evaluated by flow cytometry using commercial kits. The effect of Cilb on the cell cycle was investigated using Fluorescence-Activated Cell Sorting (FACS) analysis. Western blot analysis was used to evaluate both the inhibitory effect of Cilb on the STAT3 signaling pathway and cyclin -B1, and DNA damage by the comet assay. Results: Cilb triggers disruption of the mitochondrial membrane potential ($\Delta\Psi_m$) and consequently activated the caspases-3 and -9, as a result of the activation of the intrinsic pathway of the apoptosis. Likewise, the Cilb-induced cell cycle was arrested in S and G2/M after 24h of treatment. Cilb also reduced the expression of STAT3 and cyclin -B1. Finally, Cilb produced an antiproliferative effect at 48 and 72 h, inducing DNA damage. Conclusion: These results demonstrate Cilb-induced apoptosis and cell cycle arrest in HeLa through the inhibition of STAT3.

Torres-Moreno, H., Marcotullio, M. C., Velazquez, C., Arenas-Luna, V. M., Hernández-Gutiérrez, S., Robles-Zepeda, R. E. (2020). Cucurbitacin IIb from *ibervillea sonora* induces apoptosis and cell cycle arrest via STAT3 inhibition. *Anti-Cancer Agents in Medicinal Chemistry*, 20(10), 1188-1196. doi: 10.2174/18752062066200415101701. Article.

Desiderio Salomón Hernández Gutiérrez

SNi Nivel I

ROLE OF SODIUM TETRABORATE AS A CARDIOPROTECTIVE OR COMPETITIVE AGENT: MODULATION OF HYPERTROPHIC INTRACELLULAR SIGNALS

ABSTRACT. Boron is an essential trace element in cellular metabolism; however, the molecular mechanism of boron in the heart is unclear. In this study, we examined the effect of sodium tetraborate (as boron source) as a possible protective agent or competitive inhibitor of cardiac hypertrophy in an in vitro murine model. We evaluated different previously reported sodium tetraborate concentrations and it was found that 13 μ M improves viability without affecting the cellular structure. We demonstrated that cardiomyocytes pretreated with sodium tetraborate prevents cellular damage induced by isoproterenol (cardioprotective effect) by increasing proliferation rate and inhibiting apoptosis. In addition, the reduction of the expression of the α_1 AR and β_1 AR adrenergic receptors as well as Erk1/2 was notable. Consequently, the expression of the early response genes c-myc, c-fos and c-jun was delayed. Also, the expression of GATA-4, NFAT, Nkx2.5 and myogenin transcription factors involved in sarcomere synthesis declined. In contrast, cardiomyocytes, when treated simultaneously with sodium tetraborate and isoproterenol, did not increase their

size (cytoplasmic gain), but an increase in apoptosis levels was observed; therefore, the proliferation rate was reduced. Although the mRNA levels of α_1 AR and β_1 AR as well as Erk1/2 and Akt1 were low at 24 h, their expression increased to 48 h. Notably, the mRNA of expression levels of c-myc, c-fos and c-jun were lower than those determined in the control, while the transcription factors GATA-4, MEF2c, Nkx2.5, NFAT and CDK9 were determined in most cells. These results suggest that pretreatment with sodium tetraborate in cardiomyocytes inhibits the hypertrophic effect. However, sodium tetraborate attenuates isoproterenol induced hypertrophy damage in cardiomyocytes when these two compounds are added simultaneously.

Hernández-Gutiérrez, S., Roque-Jorge, J., López-Torres, A., Díaz-Rosas, G., García-Chequer, A. J., Contreras-Ramos, A. (2020). Role of sodium tetraborate as a cardioprotective or competitive agent: Modulation of hypertrophic intracellular signals., *Journal of Trace Elements in Medicine and Biology*, 62. doi: 10.1016/j.jtemb.2020.126569. Article.

María Lilia Loredo Mendoza

Profesor investigador

EFFECTS OF ALLICIN ON PATHOPHYSIOLOGICAL MECHANISMS DURING THE PROGRESSION OF NEPHROPATHY ASSOCIATED TO DIABETES

ABSTRACT. This study aimed to assess the impact of allicin on the course of diabetic nephropathy. Study groups included control, diabetes, and diabetes-treated rats. Allicin treatment (16 mg/kg day/p.o.) started after 1 month of diabetes onset and was administered for 30 days. In the diabetes group, the systolic blood pressure (SBP) increased, also, the oxidative stress and hypoxia in the kidney cortex were evidenced by alterations in the total antioxidant capacity as well as the expression of nuclear factor (erythroid-derived 2)-like 2/Kelch ECH associating protein 1 (Nrf2/Keap1), hypoxia-inducible factor 1- α (HIF-1 α), vascular endothelial growth factor (VEGF), erythropoietin (Epo) and its receptor (Epo-R). Moreover, diabetes increased nephrin, and kidney injury molecule-1 (KIM-1) expression that correlated with mesangial matrix, the fibrosis index and with the expression of connective tissue growth factor (CTGF), transforming growth factor- β_1 (TGF- β_1), and α -smooth muscle actin (α -SMA). The insulin levels and glucose transporter protein type-4 (GLUT4) expression were decreased; otherwise, insulin receptor substrates 1 and 2 (IRS-1 and IRS-2) expression was increased. Allicin increased Nrf2 expression and decreased SBP, Keap1, HIF-1 α , and VEGF expression. Concurrently, nephrin, KIM-1, the mesangial matrix, fibrosis index, and the fibrotic proteins were decreased. Additionally, allicin decreased hyperglycemia, improved insulin

levels, and prevented changes in (GLUT4) and IRSs expression induced by diabetes. In conclusion, our results demonstrate that allicin has the potential to help in the treatment of diabetic nephropathy. The cellular mechanisms underlying its effects mainly rely on the regulation of antioxidant, antifibrotic, and anti-diabetic mechanisms, which can contribute towards delay in the progression of renal disease.

Arellano-Buendía, A. S., Castañeda-Lara, L. G., Lored-Mendoza, M. L., García-Arroyo, F. E., Rojas-Morales, P., Argüello-García, R., Juárez-Rojas, J. G., Tapia, E., Pedraza-Chaverri, J., Sánchez-Lozada, L. G., & Osorio-Alonso, H. (2020). Effects of allicin on pathophysiological mechanisms during the progression of nephropathy associated to diabetes. *Antioxidants*, 9(11), 1-20. doi: 10.3390/antiox911134. Article.

María Lilia Lored Mendoza

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THE ROLE OF INFLAMMATION IN DRIVING LEFT VENTRICULAR REMODELING IN A PRE-HFPEF MODEL

ABSTRACT. We previously reported on the development of left ventricular (LV) structural and functional changes in an aged, female rat model where the effects of ovariectomy and excess weight (stimulated by fructose in water) were also explored. Ovariectomy and/or excess weight led to a prolongation of active relaxation, loss of cardiac output, and LV fibrosis in the setting of preserved ejection fraction. In this follow-up study, we wished to characterize the possible role of LV inflammation, oxidative stress (OS), and cell death in inducing such changes. Four experimental groups were studied: young (3 months old), aged (18 months old), aged + ovariectomy (OVX), and aged + ovariectomy + 10% fructose (OVF). Using conventional histology and immunohistochemistry of myocardium as well as biochemical assays of plasma samples, we document the presence of inflammatory cell aggregates in LV myocardium which are associated to high levels of plasma inflammatory cytokines (IL-1 β , TNF- α , IFN- γ , TGF- β 1) and OS (carbonyl proteins) in aged, OVX, and OVF vs. young animals. In the inflammatory areas, normal cardiac tissue was substituted by replacement and interstitial fibrosis and M1 macrophages, (as per by CD68 immunostaining) as we all as by co-localization with TGF- β 1. We also document increases in plasma troponin I levels, loss of capillary density, cardiomyocyte hypertrophy, and death. Select changes were further aggravated by ovariectomy and/or excess weight. In conclusion, aging in the female rat heart, when compounded with estrogen depletion and excess weight promotes the development of greater levels inflammation, OS, fibrosis, capillary rarefaction, cardiomyocyte hypertrophy, and injury/death. These factors likely play an important role in the development of LV remodeling that leads to the development

of a “pre-HFpEF” phenotype. Impact statement: The incidence of HFpEF continues to increase and ~2/3 of the patient population are post-menopausal women. Unfortunately, most studies focus on the use of male animal models of remodeling. In this study, however, using female rats to set a model of pre-HFpEF, we provide insights to possible mechanisms that contribute to HFpEF development in humans that will lead us to a better understanding of the underlying pathophysiology of HFpEF.

Lored-Mendoza, M. L., Ramirez-Sanchez, I., Bustamante-Pozo, M. M., Ayala, M., Navarrete, V., Garate-Carrillo, A., Ito, B. R., Ceballos, G., Omens, J., Villarreal, F. (2020). The role of inflammation in driving left ventricular remodeling in a pre-HFpEF model. *Experimental Biology and Medicine*, 8(1), 748-757. doi: 10.1177/1535370220912699. Article.

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SNI Nivel III

PAIN REDUCTION WITH VR IN INDIGENOUS VS URBAN PATIENTS IN AMBULATORY SURGERY

ABSTRACT. The current report presents comparisons of pain reduction and heart rate response using supplemental virtual reality (VR) pain distraction between 22 indigenous and 22 urban patients during ambulatory surgery. Material and methods. Forty-four (44) patients participated under full informed consent. Half (n = 22) were indigenous peoples and half (n = 22) were urban patients (those residing in Mexico City). For the urban group, a surgeon performed ambulatory surgeries with local anesthesia to remove lesions in soft tissues, such as lipomas, cysts located in the head, neck, back, shoulders, arms, limbs, and abdomen. For the indigenous group, operating rooms, intravenous line, analgesics, and sedatives were not used. Materials included laptop-linked virtual reality, PlayStation, Smartphones and Google Cardboard googles alongside virtual environments such as Enchanted Forest, The Sea, Lake Valley, Jurassic Dinosaur and Coast Space VR. Results. Pain scale indicated 2.92 before, 1.67 during and 0.67 after for indigenous participants, and 5.8 before, 3.32 during and 1.48 after for urban participants. Heart rate responses in indigenous were 80.42(before), 78.5 (during) and 72.42 (after) and urban responses were 74.07 (before), 68.53 (during) and 73.1(after). Discussion. Indigenous patients presented more pain reduction during ambulatory surgery without intravenous lines, analgesics or sedatives and required recovery time or hospitalization. Supplemental VR during medical and surgical procedures is discussed in light of cultural, economic and psychological variables associated with medical care in Mexico.

Mosso Vázquez, J. L., Tomás Obrador, G., Mosso Lara, D., Luis Mosso Lara, J., Wiederhold, B. K., Lara Vaca, V., Miller, I., Wiederhold, M. D., Michael, A., Lange, J., Yu Gillette, S. (2019). Pain reduction with VR in indigenous vs urban patients in ambulatory surgery. *Annual Review of CyberTherapy and Telemedicine*, 17, 99-104. Article.

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Profesor investigador

VIRTUAL REALITY AND MINIMAL ANALGESIA ATTENUATE PAIN DURING SPINE SURGERY

ABSTRACT. We present progress with 17 cases of virtual reality (VR) therapy to reduce pain and anxiety during interventional treatment under radiology guidance on patients diagnosed with intense and chronic back pain with narrow channel syndrome and lumbar disc hernias. **Methodology.** Patients under informed consent fitted with a head mounted display (HMD), to allow them to navigate in VR scenarios, lie in a prone position. The procedure begins using minimal analgesia with an intravenous single dose with fentanyl 50 mcg without sedation. We infiltrate locally with local anesthesia (lidocaine 1%); depending on the interventional procedure involved. The interventional procedures were: discography with discolysis with ozone, caudal blockages, and foramina blocks. During the procedure, patients navigate VR scenarios created at the Virtual Reality Medical Center in San Diego (Dr. Brenda Wiederhold). At the end of the procedure, patients recover for one to two hours before leaving the Surgical Center. **Results.** No statistically significant increase in pain ratings from baseline through procedure were noted, however, a significant decrease was noted post-operatively. The attenuation of pain due to VR distraction in 17 patients allowed the procedure to be non-sedative (Midazolam was not used). **Conclusions.** Advantages of VR therapy include a high degree of patient satisfaction, minimal risk without sedatives, such as midazolam, maintenance of patient's conscious awareness, stress reduction in the patient, stress reduction in the anesthesiologist, and cooperation with the patient. The non-invasive VR equipment used is portable, reliable, and led to a better patient-physician relationship. VR therapy during pain treatment is an excellent option in the pain clinic. Chronic pain treated with anti-inflammatories administered directly to the spine and local ozone is an area in which the use of VR can significantly reduce pain. With this experience we demonstrate the cost benefit advantage that also offers satisfaction to patients while offering savings to health institutions. No complications were presented.

Mosso Vázquez, J. L., Canseco Aguilar, P., Mosso Lara, D., Miller, I., Wiederhold, B. K., & Wiederhold, M. D. (2019). Virtual reality and minimal analgesia attenuate pain during spine surgery. *Annual Review of CyberTherapy and Telemedicine*, 17, 153-157. Article.

José Luis Mosso Vázquez

Profesor investigador

VIRTUAL REALITY PAIN MITIGATION DURING ELECTIVE CESAREAN SURGICAL DELIVERY

ABSTRACT. We present supplemental virtual reality (VR) relaxation to reduce pain and anxiety during elective cesarean delivery in 4 young women under epidural analgesia. **Methodology.** Four women voluntarily participated in a VR relaxation group (mean age = 28.5 years) and four women in a control group (mean age = 30.5 years). VR relaxation was initiated for the placement of the epidural block and cesarean procedure until the gynecologist extracted the newborn from the uterus. The mother's vital signs and pain were measured using physiological monitoring and a visual analog scale before, during and after anesthesia placement and during and after cesarean surgery. Participants viewed an 'Enchanted Forest' virtual environment. Three of the four patients' husbands participated by navigating the virtual environment for his wife using a game controller. **Results.** Patients presented 91.89 % pain reduction in the VR group—a remarkable result under regional anesthesia. Patients in the control group presented 61 % increases in pain. **Conclusions.** VR supplemented pain mitigation provides high levels of satisfaction to mothers during elective cesarean delivery and carries no risk for the newborns. The current report highlights an innovative contribution to women's healthcare.

Mosso Vázquez, J. L., Mosso Lara, D., Lara Vaca, V., Wiederhold, B. K., Miller, I., Rivas, H., & Wiederhold, M. D. (2019). Virtual reality pain mitigation during elective cesarean surgical delivery. *Annual Review of CyberTherapy and Telemedicine*, 17, 105-114. Article.

Gregorio Tomás Obrador Vera

SNi Nivel III

CHALLENGES FOR SUSTAINABLE END-STAGE KIDNEY DISEASE CARE IN LOW-MIDDLE-INCOME COUNTRIES: THE PROBLEM OF THE WORKFORCE

ABSTRACT. Prevention and early detection of kidney diseases in adults and children should be a priority for any government health department. This is particularly pertinent in the low-middle-income countries, mostly in Asia, Africa, Latin America, and the Caribbean, where up to 7 million people die because of lack of end-stage kidney disease treatment. The nephrology workforce (nurses, technicians, and doctors) is limited in these countries and expanding the size and expertise of the workforce is essential to permit expansion of treatment for both chronic kidney disease and end-stage kidney disease. To achieve this will require sustained action and commitment from governments, academic medical centers, local nephrology societies, and the international nephrology community.

Swanepoel, C. R., McCulloch, M. I., Abraham, G., Donner, J. -A., Alruhaimi, M. N., Blake, P. G., Bunnag, S., Claus, S., Dreyer, G., Ghnaimat, M. A., Ibhaïs, F. M., Liew, A., McKnight, M., Mengistu, Y. T., Naicker, S., Niang, A., Obrador, G. T., Perl, J., Rashid, H. U., Tonelli, M., Tung-sanga, K., Vachharajani, T., Zakharova, E., Zuniga, C., & Finkelstein, F. O. (2020). Challenges for sustainable end-stage kidney disease care in low-middle-income countries: the problem of the workforce. *Kidney International Supplements*, 10(1), e49-e54. doi: 10.1016/j.kisu.2019.11.007. Review.

Gregorio Tomás Obrador Vera

SNI Nivel III

Evandro Agazzi

SNI Nivel III

CONCORDANCE AMONG PATIENTS AND PHYSICIANS ABOUT THEIR IDEAL OF AUTONOMY IMPACTS THE PATIENT-DOCTOR RELATIONSHIP: A CROSS-SECTIONAL STUDY OF MEXICAN PATIENTS WITH RHEUMATIC DISEASES

ABSTRACT. Introduction In patient-doctor interaction both parties play a role. Primary objective was to determine if the concordance among rheumatologists and their patients of their ideal of autonomy was associated with a better patient-doctor relationship. Secondary objective was to describe factors associated to a patient paternalistic ideal of autonomy (PPIA). Materials and methods This cross-sectional study had 3 steps. Step-1 consisted in translation/cultural local adaption of Ideal Patient Autonomy Scale (IPAS), a 14-items Dutch questionnaire. Step-2 consisted of IPAS validity and reliability in 201 outpatients. Step-3 consisted of the application of IPAS and the patient-doctor relationship questionnaire (PDRQ) to 601 outpatients with a medical encounter, and of IPAS to the 21 attending rheumatologists. Each patient-physician encounter was classified into with/without concordance in the ideal of autonomy and PRDQ scores were compared (Man Whitney U test). Regression analysis was used for associations. Results Step-1 followed ISPOR task force recommendations. Patients from Step-2 and Step-3 were representative outpatients with rheumatic diseases. IPAS structure underwent a modification; the 14 items were redistributed into four subscales, further combined into PPIA vs. patient-centered autonomy ideal. IPAS was valid and reliable. There were 497 patients with a preferred ideal of autonomy, primarily (84.9%) PPIA. There were 363 patient-doctor encounters with concordance in the autonomy ideal and their PDRQ-9 scores were higher. Religious beliefs and higher PDRQ-9 item 8 score ("I feel pleased with my doctor's treatment") were associated to a PPIA. Conclusions Concordance of autonomy ideal among patients and their rheumatologists positively impacts on the patient-doctor relationship.

Pascual-Ramos V., Contreras-Yáñez I., Ortiz-Haro A. B., Albert C. M., Obrador G. T., & Agazzi E. (2020). Concordance among patients and physicians about their ideal of autonomy impacts the patient-doctor relationship: A cross-sectional study of Mexican patients with rheumatic diseases. *PLoS ONE*, 15(10). doi: 10.1371/journal.pone.0240897. Article.

Gregorio Tomás Obrador Vera

SNI Nivel III

IDENTIFYING DIMENSIONS OF FATIGUE IN HAEMODIALYSIS IMPORTANT TO PATIENTS, CAREGIVERS AND HEALTH PROFESSIONALS: AN INTERNATIONAL SURVEY

ABSTRACT. Background: Patient-reported outcome measures of fatigue used in research in haemodialysis vary widely in the dimensions assessed; and the importance of these dimensions to patients and health professionals is unknown. This study aimed to identify the most important dimensions of fatigue to assess in patients on haemodialysis participating in trials. Methods: In an international survey, patients/caregivers and health professionals rated the absolute and relative importance of content and measurement dimensions to include in a core outcome measure of fatigue. A 9-point Likert scale (7–9 indicating critical importance) was used to assess absolute importance and best-worst scale was used to assess importance of each dimension compared to others. Results: In total, 169 patients/caregivers and 336 health professionals from 60 countries completed the survey. Both groups (patients/caregivers and health professionals) rated life participation (7.55), tiredness (7.40), level of energy (7.37), ability to think clearly (7.15), post-dialysis fatigue (7.13), motivation (7.03) and ability to concentrate (7.03) as critically important (mean Likert score greater than 7) content dimensions to include in a core outcome measure. Compared to patients and caregivers, health professionals rated post-dialysis fatigue, memory and verbal abilities more highly. Based on the relative importance scores, life participation was ranked most highly above all content dimensions. Severity was rated and ranked the most important measurement dimension by all stakeholders. Conclusion: A core outcome measure of fatigue should assess impact of fatigue on life participation, tiredness and level of energy, using a severity scale. A consistent and valid measurement of fatigue will improve the value of trials in supporting decision-making based on this important outcome.

Ju, A., Unruh, M., Davison, S. N., Dapuelto, J., Dew, M. A., Fluck, R., Germain, M., Jassal, S. V., Obrador, G., O'Donoghue, D., Howell, M., O'Lone, E., Shen, J. I., Craig, J. C., Tong, A., & for The SONG-HD Initiative (2019). Identifying dimensions of fatigue in haemodialysis important to patients, caregivers and health professionals: An international survey. *Nephrology*, 25(3), 239-247. doi: 10.1111/nep.13638. Article.

SUPPORTIVE CARE FOR END-STAGE KIDNEY DISEASE: AN INTEGRAL PART OF KIDNEY SERVICES ACROSS A RANGE OF INCOME SETTINGS AROUND THE WORLD

ABSTRACT. A key component of treatment for all people with advanced kidney disease is supportive care, which aims to improve quality of life and can be provided alongside therapies intended to prolong life, such as dialysis. This article addresses the key considerations of supportive care as part of integrated end-stage kidney disease care, with particular attention paid to programs in low- and middle-income countries. Supportive care should be an integrated component of care for patients with advanced chronic kidney disease, patients receiving kidney replacement therapy (KRT), and patients receiving non-KRT conservative care. Five themes are identified: improving information on prognosis and support, developing context-specific evidence, establishing appropriate metrics for monitoring care, clearly communicating the role of supportive care, and integrating supportive care into existing health care infrastructures. This report explores some general aspects of these 5 domains, before exploring their consequences in 4 health care situations/settings: in people approaching end-stage kidney disease in high-income countries and in low- and middle-income countries, and in people discontinuing KRT in high-income countries and in low- and middle-income countries.

Hole, B., Hemmelgarn, B., Brown, E., Brown, M., McCulloch, M. I., Zuniga, C., Andreoli, S. P., Blake, P. G., Couchoud, C., Cueto-Manzano, A. M., Dreyer, G., Garcia Garcia, G., Jager, K. J., McKnight, M., Morton, R. L., Murtagh, F. E. M., Naicker, S., Obrador, G. T., Perl, J., Rahman, M., Shah, K. D., Van Biesen, W., Walker, R. C., Yeates, K., Zemchenkov, A., Zhao, M. -H., Davies, S. J., & Caskey, F. J. (2020). Supportive care for end-stage kidney disease: an integral part of kidney services across a range of income settings around the world. *Kidney International Supplements*, 10(1), e86-e94. doi: 10.1016/j.kisu.2019.11.008. Review.

VALIDATION OF A CORE PATIENT-REPORTED OUTCOME MEASURE FOR FATIGUE IN PATIENTS RECEIVING HEMODIALYSIS: THE SONG-HD FATIGUE INSTRUMENT

ABSTRACT. Background and objectives Fatigue is a very common and debilitating symptom and identified by patients as a critically important core outcome to be included in all trials involving patients receiving hemodialysis. A valid, standardized measure

for fatigue is needed to yield meaningful and relevant evidence about this outcome. This study validated a core patient-reported outcome measure for fatigue in hemodialysis. Design, setting, participants, & measurements A longitudinal cohort study was conducted to assess the validity and reliability of a new fatigue measure (Standardized Outcomes in Nephrology-Hemodialysis Fatigue [SONGHD Fatigue]). Eligible and consenting patients completed the measure at three time points: baseline, a week later, and 12 days following the second time point. Cronbach α and intraclass correlation coefficient were calculated to assess internal consistency, and Spearman rho was used to assess convergent validity. Confirmatory factor analysis was also conducted. Hemodialysis units in the United Kingdom, Australia, and Romania participated in this study. Adult patients aged 18 years and over who were English speaking and receiving maintenance hemodialysis were eligible to participate. Standardized Outcomes in Nephrology-Hemodialysis, the Visual Analog Scale for fatigue, the 12-Item Short Form Survey, and Functional Assessment of Chronic Illness Therapy-Fatigue were used. Results In total, 485 participants completed the study across the United Kingdom, Australia, and Romania. Psychometric assessment demonstrated that Standardized Outcomes in Nephrology-Hemodialysis is internally consistent (Cronbach α = 0.81–0.86) and stable over a 1-week period (intraclass correlation coefficient = 0.68–0.74). The measure demonstrated convergence with Functional Assessment of Chronic Illness Therapy-Fatigue and had moderate correlations with other measures that assessed related but not the same concept (the 12-Item Short Form Survey and the Visual Analog Scale). Confirmatory factor analysis supported the one-factor model. Conclusions SONG-HD Fatigue seems to be a reliable and valid measure to be used in trials involving patients receiving hemodialysis.

Ju, A., Teixeira-Pinto, A., Tong, A., Smith, A. C., Unruh, M., Davison, S. N., Daputo, J., Dew, M. A., Fluck, R., Germain, M. J., Jassal, S. V., Obrador, G. T., O'donoghue, D., Viece, A. K., Strippoli, G., Ruospo, M., Timofte, D., Sharma, A., Au, E., Howell, M., Costa, D. S. J., Anumudu, S., Craig, J. C., & Rutherford, C. (2020). Validation of a core patient-reported outcome measure for fatigue in patients receiving hemodialysis: The SONG-HD fatigue instrument. *Clinical Journal of the American Society of Nephrology*, 15(11), 1614-1621. doi: 10.2215/CJN.05880420. Article.

WNK3 AND WNK4 EXHIBIT OPPOSITE SENSITIVITY WITH RESPECT TO CELL VOLUME AND INTRACELLULAR CHLORIDE CONCENTRATION

ABSTRACT. Cation-coupled chloride cotransporters (CCC) play a role in modulating intracellular chloride concentration ([Cl⁻]_i) and cell volume. Cell shrinkage

and cell swelling are accompanied by an increase or decrease in $[Cl^-]_i$, respectively. Cell shrinkage and a decrease in $[Cl^-]_i$ increase the activity of NKCCs (Na-K-Cl cotransporters: NKCC1, NKCC2, and Na-Cl) and inhibit the activity of KCCs (K-Cl cotransporters: KCC1 to KCC4), whereas cell swelling and an increase in $[Cl^-]_i$ activate KCCs and inhibit NKCCs; thus, it is unlikely that the same kinase is responsible for both effects. WNK1 and WNK4 are chloride-sensitive kinases that modulate the activity of CCC in response to changes in $[Cl^-]_i$. Here, we showed that WNK3, another member of the serine-threonine kinase WNK family with known effects on CCC, is not sensitive to $[Cl^-]_i$ but can be regulated by changes in extracellular tonicity. In contrast, WNK4 is highly sensitive to $[Cl^-]_i$ but is not regulated by changes in cell volume. The activity of WNK3 toward NaCl cotransporter is not affected by eliminating the chloride-binding site of WNK3, further confirming that the kinase is not sensitive to chloride. Chimeric WNK3/WNK4 proteins were produced, and analysis of the chimeras suggests that sequences within the WNK's carboxy-terminal end may modulate the chloride affinity. We propose that WNK3 is a cell volume-sensitive kinase that translates changes in cell volume into phosphorylation of CCC.

Pacheco-Alvarez, D., Carrillo-Pérez, D. L., Mercado, A., Leyva-Ríos, K., Moreno, E., Hernández-Mercado, E., Castañeda-Bueno, M., Vázquez, N., & Gamba, G. (2020). WNK3 and WNK4 exhibit opposite sensitivity with respect to cell volume and intracellular chloride concentration. *American journal of physiology - Cell Physiology*, 319(2), C371-C380. doi: 10.1152/ajpcell.00488.2019. Article.

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LONG-TERM EFFECTIVENESS OF POLYMERIZED-TYPE I COLLAGEN INTRA-ARTICULAR INJECTIONS IN PATIENTS WITH SYMPTOMATIC KNEE OSTEOARTHRITIS: CLINICAL AND RADIOGRAPHIC EVALUATION IN A COHORT STUDY

ABSTRACT. Objective. Polymerized-type I collagen (polymerized-collagen) is a downregulator of inflammation and a tissue regenerator. The aim was to evaluate the effect of intra-articular injections (IAls) of polymerized-collagen among patients with symptomatic knee osteoarthritis (OA) in delaying or preventing joint replacement surgery. Patients and Methods. This was a cohort study of 309 patients with knee OA. Patients with mild-to-moderate disease were treated weekly with IAls of 2 mL of polymerized-collagen for six weeks ($n = 309$). Follow-up was for 6-60 months. The primary endpoints included the following determinations: (1) therapeutic effect; (2) survival from total knee replacement surgery (TKR); (3) Western Ontario and McMaster University Osteoarthritis

Index (WOMAC) and pain (visual analogue scale, VAS). Clinical improvement was defined as a decrease in pain exceeding 20 mm on the VAS and the achievement of at least 20% improvement from baseline with respect to the WOMAC score. Radiographic analysis was performed at baseline and 60 months. The joint space width in the medial, lateral, and patellofemoral compartments was calculated. Results. Patients who received IAls of polymerized-collagen had a statistically significant improvement in the primary criteria ($p < 0.05$). Kaplan-Meier survival analysis of the therapeutic effect demonstrated 98.8% survival at 60 months with TKR as the endpoint. There was no significant reduction in joint space in any compartment based on the analyzed radiographs. No serious adverse events were recorded. Conclusion. Polymerized-collagen increased the time to TKR by at least 60 months, modifying the disease course, improving functional disability, and decreasing pain.

Borja-Flores, A., Macías-Hernández, S. I., Hernández-Molina, G., Pérez-Ortiz, A., Reyes-Martínez, E., Belzazar-Castillo De La Torre, J., Ávila-Jiménez, L., Vázquez-Bello, M. C., León-Mazón, M. A., Furuzawa-Carballeda, J., Torres-Villalobos, G., Romero-Hernández, F., Albavera-Hernández, C., Pérez-Correa, J., & Castro-Rocha, H. A. (2020). Long-Term Effectiveness of Polymerized-Type I Collagen Intra-Articular Injections in Patients with Symptomatic Knee Osteoarthritis: Clinical and Radiographic Evaluation in a Cohort Study. *Advances in Orthopedics*, 2020. doi: 10.1155/2020/9398274. Article.

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LONG-TERM RISK OF ADULT OVERWEIGHT AND OBESITY AMONG ACHALASIA PATIENTS WHO UNDERWENT HELLER MYOTOMY

ABSTRACT. Background: It is unknown whether surgically treated achalasia cases regain or surpass their usual weight into obesity or overweight in the long-term post-operative period. Here, we aimed to assess the incidence of overweight/obesity (Ob/Ow) and the risk for reoccurrence up to 48 months post-laparoscopic Heller myotomy (LHM). Methods: We performed a cohort of 114 achalasia cases undergoing LHM. All patients had a confirmed diagnosis of achalasia and had no added comorbidities. We followed up the body mass index (BMI) at the immediate post-operative period, and at one-, six-, 12-, 24-, and 48 months after LHM. We measured the incidence of Ob/Ow and its reoccurrence risk with Cox regression. Key Results and Conclusions: In the immediate post-operative period, the incidence of Ob/Ow was significantly less than the usual BMI (before the onset of symptoms) (28.2% vs 66.3%). From the sixth to the 48th month, there was a progressive increase in the incidence of Ob/Ow

and at this timepoint the percent of Ob/Ow was not statistically different from the usual BMI. The most significant hazard for Ob/Ow reoccurrence in the long term following LHM is a usual BMI with obesity grade I or III and males lacking pre-surgical weight loss. Inferences: Achalasia cases undergoing surgical treatment should be monitored closely in the post-operative period for weight regain, regardless of their pre-operative BMI. Notably, males who before the onset of symptoms were obese or overweight are at significantly increased risk of regaining or surpassing their weight, despite most having lost weight pre-surgically.

Perez-Ortiz, A. C., Narváez-Chávez, S., Furuzawa-Carballeda, J., Coss-Adame, E., Valdovinos-Díaz, M. A., Peralta-Figueroa, J., Olvera-Prado, H., López-Verdugo, F., Sánchez-García Ramos, E., & Torres-Villalobos, G. (2020). Long-term risk of adult overweight and obesity among achalasia patients who underwent Heller Myotomy. *Neurogastroenterology and Motility*, 32(10). doi: 10.1111/nmo.13921. Article.

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MICROSPHEROPHAKIA IN A 47, XXX SYNDROME PATIENT: A CASE REPORT

ABSTRACT. 47, XXX syndrome affects males with variable phenotypic expression. Around 80-99% of affected individuals present low-set ears, malar flattening, motor delay, and tall stature. Yet, some cases lack signs or symptoms or are barely noticeable. There are four reports of ocular involvement among these individuals - one with unusual multiple retinal atrophic holes in the posterior pole, other with coloboma, an association with morning glory syndrome, and a case of congenital cataract. Here, we describe a plausible new ocular sign in a 4-year-old male with 47, XXX syndrome who was brought to the outpatient clinic for vision loss. After a complete assessment, we diagnosed a right-sided phacomorphic glaucoma and microspherophakia treated with phacoemulsification and aspiration with posterior capsulotomy and anterior vitrectomy, followed by an Ahmed valve implant for intraocular pressure control. Even though there is a low prevalence of ocular involvement in 47, XXX syndrome cases, this might reflect the rarity of the full expression of the disease leading to an underdiagnosis, added to the scarcity of cases. Microspherophakia and phacomorphic glaucoma among four others previously reported ocular findings could be looked for in 47, XXX syndrome patients.

Rubalcava-Soberanis, M. L., Antonio-Aguirre, B., Mendoza Velásquez, C., Perez-Ortiz, A. C., & Palacio-Pastrana, C. (2019). Microspherophakia in a 47, XXX Syndrome Patient: A Case Report. *Case Reports in Ophthalmology*, 11(1), 1-7. doi: 10.1159/000505058. Article.

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SPHEROPHAKIA AND ECTOPIA LENTIS IN A STURGE-WEBER PATIENT: A CASE REPORT

ABSTRACT. Sturge-Weber syndrome (SWS) is a rare, sporadic neurocutaneous disorder, primarily characterized by port-wine stain (PWS) over the ophthalmic division of the trigeminal nerve (V1) territory (hallmark feature) and glaucoma (in 30-60% of cases). Other ocular manifestations include episcleral involvement of the PWS, choroidal vascular malformations, and iris heterochromia. Two previous reports also associated ectopia lentis concomitantly among these cases. However, here we report spherophakia as a novel ophthalmological finding in SWS. A 56-year-old female previously diagnosed with SWS presented to the outpatient clinic complaining of right-sided decreased visual acuity and pain after a fall. Phenotypically, the patient had a PWS around V1 territory and involvement of both eyelids. Previous relevant ocular history included retinal detachment without macular involvement, ocular hypertension, and phacodonesis. The slit-lamp examination showed anterior lens luxation and elevated intraocular pressure (IOP) of 40 mm Hg by tonometry. Prior to the surgical approach, the patient received hypotensive treatment for elevated IOP. After intracapsular lens extraction, measurements were consistent with spherophakia. Postoperatively, the patient underwent optical coherence tomography (OCT). There was cystic macular edema (CME) by OCT and a detached posterior hyaloid membrane. The patient fully recovered with topical treatment of bromfenac for CME. To the best of our knowledge, this is the first report of concomitant anterior lens luxation and spherophakia (novel association) in a SWS patient. Our findings supplement the differential ocular diagnoses in SWS and should be considered in the routine ocular exam, specifically of the anterior segment. CME occurred similar to otherwise healthy eyes. However, in this case, topical anti-inflammatory medications had a good response and were well-tolerated.

Avalos-Lara, S. J., Antonio-Aguirre, B., Perez-Ortiz, A. C., Mendoza Velásquez, C., Camacho-Ordoñez, A., Palacio Pastrana, C. (2020). Spherophakia and Ectopia Lentis in a Sturge-Weber Patient: A Case Report. *Case Reports in Ophthalmology*, 11(2), 356-363. doi: 10.1159/000508064. Article.

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PHIMOSIS: A RARE COMPLICATION OF IMMUNOTHERAPY WITH DURVALUMAB

ABSTRACT. We present a case of a 69 year old man with phimosis associated with immunotherapy

with durvalumab for metastatic non-small-cell lung cancer. The patient developed vitiligo like dermatosis after the induction dose of durvalumab, subsequent administration of the immunotherapy the patient developed a fibrous ring of the foreskin. Immune-mediated adverse reactions have been described after the use of durvalumab, but, to our knowledge, there are no reports of phimosis and vitiligo like reactions.

Vázquez-Lavista, L. G., Llorente, L., Alatorre-Alexander, J., Ramírez-Muciño, J. A. (2020). Phimosis: A rare complication of immunotherapy with durvalumab. *Urology Case Reports*, 33. doi: 10.1016/j.eucr.2020.101350. Article.

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DIRECT OR COLLATERAL LIVER DAMAGE IN SARS-COV-2-INFECTED PATIENTS

ABSTRACT. Liver injury can result from severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection with more than one-third of COVID-19 patients exhibiting elevated liver enzymes. Microvesicular steatosis, inflammation, vascular congestion, and thrombosis in the liver have been described in autopsy samples from COVID-19 patients. Several factors, including direct cytopathic effect of the virus, immune-mediated collateral damage, or an exacerbation of preexisting liver disease may contribute to liver pathology in COVID-19. Due to its immunological functions, the liver is an organ likely to participate in the viral response against SARS-CoV-2 and this may predispose it to injury. A better understanding of the mechanism contributing to liver injury is needed to develop and implement early measures to prevent serious liver damage in patients suffering from COVID-19. This review summarizes current reports of SARS-CoV-2 with an emphasis on how direct infection and subsequent severe inflammatory response may contribute to liver injury in patients with and without preexisting liver disease.

Lizardo-Thiebaud, M. J., Cervantes-Alvarez, E., Limon-de la Rosa, N., Tejeda-Dominguez, F., Palacios-Jimenez, M., Méndez-Guerrero, O., Delaye-Martinez, M., Rodríguez-Alvarez, F., Romero-Morales, B., Liu, W. -H., Huang, C. A., Kershenovich, D., Navarro-Alvarez, N. (2020). Direct or Collateral Liver Damage in SARS-CoV-2-Infected Patients. *Seminars in liver disease*, 40(3), 321-330. doi: 10.1055/s-0040-1715108. Article.

María Oa Valenzuela Almada

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BIASES IN DIAGNOSTIC TEST STUDIES: IMPACT ON ESTIMATING SENSITIVITY AND SPECIFICITY

[SESGOS EN LOS ESTUDIOS DE PRUEBAS DE DIAGNÓSTICO: IMPLICACIÓN EN LA ESTIMACIÓN DE LA SENSIBILIDAD Y ESPECIFICIDAD]

ABSTRACT. Diagnostic tests make it possible to determine whether a person has a disease or not. Before incorporating a new diagnostic test in the clinical setting, it is necessary to define its validity through its indicators of performance, sensitivity, and specificity. In these studies, like in any research, the results might not be reliable when there are biases during their execution. This article entails the discussion about the biases in diagnostic test studies that may cause inaccuracy in sensitivity and specificity. The main biases that affect the validity of these studies are: incorporation bias, partial and/or differential verification bias, an imperfect reference standard, a limited spectrum of the disease, and the ambiguous results of the test to be validated. In addition, examples of how these biases impact on the results of sensitivity and specificity are given in this paper.

Rendón-Macías, M. E., Valenzuela, M., & Villasís-Keever, M. Á. (2020). Biases in diagnostic test studies: impact on estimating sensitivity and specificity [Sesgos en los estudios de pruebas de diagnóstico: implicación en la estimación de la sensibilidad y especificidad]. *Revista Alergia Mexico*, 67(2): 165-173. doi: 10.29262/ram.v67i2.771. Article.

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ETHICAL CRITERIA FOR THE ADMISSION AND MANAGEMENT OF PATIENTS IN THE ICU UNDER CONDITIONS OF LIMITED MEDICAL RESOURCES: A SHARED INTERNATIONAL PROPOSAL IN VIEW OF THE COVID-19 PANDEMIC

ABSTRACT. The present pandemic has exposed us to unprecedented challenges that need to be addressed not just for the current state, but also for possible future similar occurrences. It is worth pointing out that discussions on the allocation of medical resources may not necessarily refer to an exception, but, unfortunately, to a regular condition for a large part of humanity. The criteria for admission to an Intensive

Care Unit (ICU) setting generally take into account multiple factors. There must be a diagnostic and prognostic basis for the decisions made, considering both biological factors and patient values and wishes. Furthermore, the decision-making process should, whenever possible, respect the patient's advance directives as well as the relationship with the patient's family or attorney. Therapeutic neglect should be avoided.

Having applied standard clinical evaluation criteria for the appropriate treatment of patients with COVID-19, including consideration of prognosis, if a hospital then finds itself unable to provide optimal treatment (e.g., due to a disproportion between the number of patients and the availability of beds, healthcare providers, ventilators, and drugs in the ICU), it becomes necessary to evaluate, case by case, how to achieve justice and the best possible good for the greatest number of patients. It is therefore mandatory to explore alternative solutions; these include increasing available beds and healthcare providers, implementing alternative, though suboptimal, approaches (where appropriate), transferring patients to other clinical units, etc. Making these decisions properly also involves the recovery of the political role of medicine and science.

If the imbalance between needs and resources reaches a critical level, an emergency triage protocol, following the operational and ethical indications of "disaster medicine," should be activated. These have been deployed in major and serious natural (earth-

quakes or tsunamis for example) and technological (factory explosions, public transport accidents for example) disasters, as well as following terrorist attacks. The question of the feasibility of developing a clinical evaluation algorithm to support the decision-making of the triage team remains open, though many such protocols have been written.

According to the above, we propose the following five ethical criteria for the triage of patients in conditions of limited resources, such as the COVID pandemic. They are the result of an interdisciplinary and intercultural dialogue between specialists from different disciplines. Several of the authors are working in the main epicenters of the crisis and currently are playing a central role in the bioethical, clinical, social and legal aspects of the management of the COVID-19 pandemic.

Tambone, V., Boudreau, D., Ciccozzi, M., Sanders, K., Campanozzi, L. L., Wathuta, J., Violante, L., Cauda, R., Petrini, C., Abbate, A., Alloni, R., Argemi, J., Renom, J. A., Benedictis, A. D., Galerneau, F., García-Sánchez, E., Ghilardi, G., Hafler, J. P., Linden, M., Marcos, A., Muda, A. O., Pandolfi, M., Pelaccia, T., Picozzi, M., Revello, R. O., Ricci, G., Rohrbaugh, R., Rossi, P., Sirignano, A., Spagnolo, A. G., Stammers, T., Velázquez, L., Agazzi, E., Mercurio, M. (2020). Ethical criteria for the admission and management of patients in the ICU under conditions of limited medical resources: A shared international proposal in view of the COVID-19 pandemic. *Frontiers in Public Health*, 8. doi: 10.3389/fpubh.2020.00284. Article.



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¹⁴ Colaboración en dos artículos publicados en Facultad de Ingeniería (pp. 117, 156).

¹⁵ Colaboración en un artículo publicado en Facultad de Ingeniería (p. 155).

¹⁶ Colaboración en un artículo publicado en Facultad de Ingeniería (p. 117).

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FACTORS ASSOCIATED WITH ELECTRICITY LOSSES: A PANEL DATA PERSPECTIVE

ABSTRACT. Electricity losses are an important problem worldwide that should be mitigated, since they generate an impact on CO₂ emissions and drive a possible rate increase. The benefits of the reduction of such losses are savings, a better environment and less infrastructure needs, amongst others. However, in order to generate reductions, it is imperative to measure the factors associated with such losses. Thus, the objective of this study is to explore the factors associated with electricity losses in the world. A database of 91 countries and 10 years of available data, from 2005 to 2014, was built, with variables taken according to our literature review and obtained from different publicly available sources. A panel data model with international information was then tested in order to find the determinants of power losses. The model with the best fit was one with random effects. Our results show that the variables unemployment and crime were significant and positive at one percent, while urbanization and education were significant and negative also at one percent. Finally, we provide some policy implications on the evidence of how electricity losses are associated with low education, high unemployment, high homicide rates, and less urbanization.

Briseño, H. & Rojas, O. (2020). Factors associated with electricity losses: A panel data perspective. *International Journal of Energy Economics and Policy*, 10(5), 281-286. doi: 10.32479/ijep.9599. Article.

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FACTORS ASSOCIATED WITH ELECTRICITY THEFT IN MEXICO

ABSTRACT. The objective of this research is to uncover some of the factors associated with electricity theft in Mexico. Econometric models of ordinary least squares with state and metropolitan information are carried out in order to know the determinants of energy theft. The models showed that there is a significant and positive relationship between electricity's theft and crime, government inefficiency, population, and population density. © 2020, Econjournals. All rights reserved.

Briseño, H. & Rojas, O. (2020). Factors associated with electricity theft in Mexico. *International Journal of Energy Economics and Policy*, 10(3), 250-254. doi: 10.32479/ijep.9002. Article.

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WILLINGNESS TO PAY TO IMPROVE WATER QUALITY IN ZAPOPAN

[DISPOSICIÓN A PAGAR PARA MEJORAR LA CALIDAD DEL AGUA EN ZAPOPAN]

ABSTRACT. The objective of this article is to explore the factors that are associated with the willingness to pay (WTP) to improve water quality in the Mexican city of Zapopan, Jalisco. A survey of four hundred households is carried out. It shows that the respondents drink bottled water (99%), consider that the supplied water smells bad (53%) and that it is contaminated (69%), they fear for their health or that of their family members from drinking from the tap (74%) but would to drink water from it if the quality improved (77%). However, more than half would not be willing to pay for an improvement in water quality or pay up to a limit of 40 pesos (31 and 22% respectively). Through an orderly logit model, it is found that there is a significant and positive relationship between the willingness to pay for improving water quality and being open to drinking tap water if it happens, perceiving the authorities responsible for water sector do the right actions, a belief of water scarcity in the colony, having people with health problems at home, and the income level. On the other hand, more willingness to pay relates negatively and significantly with the perception that water smells bad, the level of trust in others, and age.

Briseño H. & Macedo E. (2021). Willingness to pay to improve water quality in Zapopan [Disposición a pagar para mejorar la calidad del agua en Zapopan]. *Tecnología y Ciencias del Agua*, 12(1), 1-21. doi: 10.24850/J-TY-CA-2021-01-10. Article.

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Investigador Asistente, Profesor investigador

UNIVERSAL PATTERNS IN COLOR-EMOTION ASSOCIATIONS ARE FURTHER SHAPED BY LINGUISTIC AND GEOGRAPHIC PROXIMITY

ABSTRACT. Many of us "see red," "feel blue," or "turn green with envy." Are such color-emotion associations fundamental to our shared cognitive architecture, or are they cultural creations learned through our languages and traditions? To answer these questions, we tested emotional associations

of colors in 4,598 participants from 30 nations speaking 22 native languages. Participants associated 20 emotion concepts with 12 color terms. Pattern-similarity analyses revealed universal color-emotion associations (average similarity coefficient $r = .88$). However, local differences were also apparent. A machine-learning algorithm revealed that nation predicted color-emotion associations above and beyond those observed universally. Similarity was greater when nations were linguistically or geographically close. This study highlights robust universal color-emotion associations, further modulated by linguistic and geographic factors. These results pose further theoretical and empirical questions about the affective properties of color and may inform practice in applied domains, such as well-being and design.

Jonauskaitė, D., Abu-Akel, A., Dael, N., Oberfeld, D., Abdel-Khalek, A. M., Al-Rasheed, A. S., Antonietti, J.-P., Bogushevskaya, V., Chamseddine, A., Chkonia, E., Corona, V., Fonseca-Pedrero, E., Gribet, Y. A., Grimshaw, G., Hasan, A. A., Havelka, J., Hirnstein, M., Karlsson, B. S. A., Laurent, E., Lindeman, M., Marquardt, L., Mefoh, P., Papadatou-Pastou, M., Pérez-Albéniz, A., Pouyan, N., Roinishvili, M., Romanyuk, L., Salgado Montejó, A., Schrag, Y., Sultanova, A., Uusküla, M., Vainio, S., Wąsowicz, G., Zdravković, S., Zhang, M., & Mohr, C. (2020). Universal Patterns in Color-Emotion Associations Are Further Shaped by Linguistic and Geographic Proximity. *Psychological Science*, 31(10), 1245-1260. doi: 10.1177/0956797620948810. Article in Press.

Fernando Cruz Aranda

SNI Nivel I

REVERSIÓN A LA MEDIA EN LAS SERIES DE PRECIOS REALES DEL PETRÓLEO EN MÉXICO

ABSTRACT. This paper aims at showing the existence of a mean reversion pattern in the series of Mexico's oil export-real prices between January 1999 and June 2017. For this purpose we adapt a stochastic difference-equation to the series of prices of oil exported to the American Continent in order to make in-and out of sample forecasts by considering windows of six and twelve months. The main results drawn from the best-fit model for the price series of the Mayan oil variety show that, in effect, there is a long-term mean reversion of the prices initially assumed to be rational. Other statistical tests confirm that this reversal to the mean is persistent because the shocks produced on the real prices do not entail permanent changes.

Sánchez, J. C. R., Aranda, F. C., Llanos, A.C. (2020). Reversión a la media en las series de precios reales del petróleo en México. *Contaduría y Administración*, 65(4). doi: 10.22201/fca.24488410e.2020.2453. Review.

Griselda Dávila Aragón

Investigador Titular B, SNI Nivel I

Francisco Ortiz Arango

SNI Nivel II

CALCULATION OF OPERATIONAL VALUE AT RISK OF AN INSURANCE COMPANY THROUGH BAYESIAN NETWORKS

[CÁLCULO DEL VALOR EN RIESGO OPERACIONAL DE UNA EMPRESA ASEGURADORA MEDIANTE REDES BAYESIANAS]

ABSTRACT. It was in the 1990's when the concept of Operational Risk was defined, since then the institutions, especially those in the financial sector, are worried about this type of risk since their exposure could have fatal consequences. In case of the insurance sector its study originates due to the new European regulatory framework of Solvency II. The purpose of this research is the development of a methodology based on Bayesian networks to identify and measure operational risk in order to determine the solvency capital requirement in the online policy quotation process of an insurance company that recently entered into this way of operating. For this, a Bayesian network model was designed with a priori and a posteriori distributions that allowed estimating the frequency and severity of the losses, with the posteriori distributions, an estimate of the expected loss for a period of one year was made using Monte Carlo simulation.

Dávila Aragón, G. & Ortiz Arango, F. (2019). Calculation of operational value at risk of an insurance company through bayesian networks [Cálculo del valor en riesgo operacional de una empresa aseguradora mediante redes bayesianas]. *Revista de Métodos Cuantitativos para la Economía y la Empresa*, 27, 30-55. Article.

Clara Cristina Eccius Wellmann

SNI Nivel I

DEVELOPMENT OF STRUCTURE SENSE IN UNIVERSITY STUDENTS THROUGH THE USE OF VARIATION THEORY IN HANDLING RATIONAL ALGEBRAIC EXPRESSIONS

[DESARROLLO DEL SENTIDO ESTRUCTURAL EN ALUMNOS UNIVERSITARIOS MEDIANTE EL USO DE LA TEORÍA DE LA VARIACIÓN EN EL MANEJO DE EXPRESIONES ALGEBRAICAS RACIONALES]

ABSTRACT. To develop a structure sense allows a student to perform algebraic tasks in more efficient ways and with fewer errors, so it is relevant to strengthen it. This article presents the results of a study whose objective was to develop the structure sense of university students, through the creation, implementation

and testing of teaching-learning activities that, at the same time, achieve the development of skills to simplify and operate rational algebraic expressions. The activities were designed based on Variation Theory. Descriptors of the sense of structure were defined and weighted for comparison purposes. Evaluations were applied before and after the implementation of the activities, to four experimental groups and three control groups. A statistically higher structure sense level was observed in the experimental groups with respect to the control groups. This proved that it is possible to achieve a greater development of the sense of structure in students, through activities that include contrasts and variations chosen intentionally.

Gonzalez, R. A. & Eccius-Wellmann, C. (2019). Development of structure sense in university students through the use of Variation Theory in handling rational algebraic expressions [Desarrollo del sentido estructural en alumnos universitarios mediante el uso de la Teoría de la Variación en el manejo de expresiones algebraicas racionales. *Educación Matemática*, 31(2), 131-194. doi: 10.24844/EM3102.07. Article.

Clara Cristina Eccius Wellmann

SNI Nivel I

SCORE ON A MATHEMATICS DIAGNOSTIC ASSESSMENT AND ITS DEPENDENCE ON AFFECTIVE ASPECTS DUE TO MAKING MISTAKES

[DEPENDENCIA DE LA CALIFICACIÓN DE UNA EVALUACIÓN DIAGNÓSTICA EN MATEMÁTICAS CON ASPECTOS AFECTIVOS POR LA COMISIÓN DE ERRORES]

ABSTRACT. Affective aspects related to making mistakes in mathematics influence learning the subject throughout school life. This study was carried out among incoming students at a private university in Guadalajara, Mexico. They are all in the field of administration. The objective of the study was to find the underlying constructs, as well as items in Ibarra-González and Eccius-Wellmann's Affectivity towards and due to Mathematical Errors questionnaire that correlate significantly with the score on a diagnostic assessment of mathematics. Regarding the constructs, the study found that evaluation scores depended on attitudes towards errors as a learning tool and negative beliefs and emotions towards mathematics due to making mistakes. The items corresponding to the aforementioned constructs revealed that the students grade decreases according to the intensity of the student's belief that he is not by nature good at mathematics. This belief lead to making more mistakes and a lack of interest in correcting them, influencing scores negatively. Based on the results, we see the need to promote a change in the pejorative connotation of error to reduce negative beliefs towards mathematics due to making mistakes and to use errors efficiently for pedagogical purposes.

Eccius-Wellmann, C. & Ibarra-González, K. P. (2020). Score on a mathematics diagnostic assessment and its dependence on affective aspects due to making mistakes [Dependencia de la calificación de una evaluación diagnóstica en matemáticas con aspectos afectivos por la comisión de errores]. *Bolema - Mathematics Education Bulletin*, 544-563. doi: 10.1590/1980-4415v34n67a10. Article.

Clara Cristina Eccius Wellman

SNI Nivel I

Josefina del Carmen Santana Villegas

Investigador Titular D, SNI Nivel I

VARIABLES THAT INFLUENCE LANGUAGE PROFICIENCY IN STUDENTS FROM PUBLIC AND PRIVATE HIGH SCHOOLS IN MEXICO

ABSTRACT. Proficiency in a second language depends on different factors; some of these are individual, while others depend more on the social context where the learning takes place. This article describes a study that examined variables that can lead to proficiency in English as a second language. The study was carried out among first semester university students at four different institutions, three private and one public, in four cities in Mexico. Participants (N=1188) had studied at either public or private high schools, regardless of the type of university where they were enrolled. They responded to a questionnaire about their background in learning English, and they took a computer adaptive placement test to determine their language level. Multiple regression was used to determine which variables can be used to predict scores on the placement test. Results point to reading as the number one predictor of proficiency, regardless of length of instruction, previous language studies, or type of high school, suggesting that public school students can reach on average the same level of proficiency as private school students, if they read. These results suggest that extensive reading may be beneficial in improving language proficiency.

Eccius-Wellman, C., Santana, J. C. (2020). Variables that influence language proficiency in students from public and private high schools in Mexico. *Mextesol Journal*, 44(2). Article.

María de Guadalupe Gaytán Jiménez

Profesor investigador

Carlos Eduardo López Hernández

Investigador Titular B, SNI Nivel I

THE GOOD, THE BAD, AND THE UGLY: ORGANIZATIONAL EFFECTIVITY IN HUMAN RESOURCES PROCESSES

ABSTRACT. Learning outcomes: Students are expected to achieve identify the prerequisites and

basic to an institutionalization process; prioritize strategic human resources processes as a basis for the growth of the company; analyze the importance of the stages in human resources management; define the areas of opportunity and their respective action plans; and propose the leadership skills that a leader requires. Case overview/synopsis: Tramuntana® is a travel agency that stands out for being a prime service, which is promoted by its own customers. Its founder wishes to institutionalize his company. The main problem in which they face to grow and consolidate is to maintain their human resources, and in which they cannot be retained, and therefore, do not have a solid structure.

Gaytán-Jiménez, M. G., López-Hernández, C. E., & Cordeiro-Estefan, J. (2019). The good, the bad, and the ugly: organizational effectivity in human resources processes. *Emerald Emerging Markets Case Studies*, 9(3), 1-18. doi: 10.1108/EEMCS-10-2019-0291. Article.

Santiago González Gómez

SNI Nivel C

SIMILARITIES AND DIFFERENCES IN TEACHING CORPORATE SOCIAL RESPONSIBILITY: EVIDENCE FROM MEXICO AND CANADA

ABSTRACT. The need to incorporate and develop Corporate Social Responsibility (CSR) within university programs is necessary for future leaders, managers and entrepreneurs. Within the framework of CSR and stakeholder theory the paper contributes a comparative case study that utilizes curriculum and in-depth interview analysis to illustrate not only the similarities and differences in the CSR programs, but how social responsibility is taught in a Mexican and Canadian University context. The main findings are: the CSR program in Mexico is perceived as a strategic management tool that adds value to the organization and does not pay any special attention to the globalization phenomena. Whereas in Canada, social responsibility is founded on ethics, attention to the different stakeholders in a globalized environment is emphasized and the strategic importance of CSR is widely accepted. The paper provides academics and researcher insight into exploring how universities can further facilitate students as stakeholders in considering social responsibility as important and necessary to ensure CSR sustainability in practice.

González, S., Eroglu, M. S., & Barragan, S. (2016). Similarities and differences in teaching corporate social responsibility: Evidence from Mexico and Canada. *Journal on Efficiency and Responsibility in Education and Science*, 9(3), 70-80. doi: 10.7160/eriesj.2016.090303. Article.

Carlos Vladimiro González Zelaya

Profesor investigador

FAIR-MDAV: AN ALGORITHM FOR FAIR PRIVACY BY MICROAGGREGATION

ABSTRACT. Automated decision systems are being integrated to several institutions. The General Data Protection Regulation from the European Union, considers the right to explanation on such decisions, but many systems may require a group-level or community-wide analysis. However, the data on which the algorithms are trained is frequently personal data. Hence, the privacy of individuals should be protected, at the same time, ensuring the fairness of the algorithmic decisions made. In this paper we present the algorithm Fair-MDAV for privacy protection in terms of t-closeness. We show that its microaggregation procedure for privacy protection improves fairness through relabelling, while the improvement on fairness obtained equalises privacy guarantees for different groups. We perform an empirical test on Adult Dataset, carrying out the classification task of predicting whether an individual earns \$50,000 per year, after applying Fair-MDAV with different parameters on the training set. We observe that the accuracy of the results on the test set is well preserved, with additional guarantees of privacy and fairness.

Salas, J. & González-Zelaya, C. V. (2020). Fair-MDAV: An algorithm for fair privacy by microaggregation. In: Torra V., Narukawa Y., Nin J., Agell N. (eds.), *Modeling Decisions for Artificial Intelligence. MDAI 2020. Lecture Notes in Computer Science*, vol 12256 (pp. 286-297). Cham, Switzerland: Springer. doi: 10.1007/978-3-030-57524-3_24. Book Chapter.

Andrée Marie López Fernández

SNI Nivel I

PRICE SENSITIVITY VERSUS ETHICAL CONSUMPTION: A STUDY OF MILLENNIAL UTILITARIAN CONSUMER BEHAVIOR

ABSTRACT. Millennial consumers have been associated with a preference for environmental, socially responsible, and high-tech products; they have also been known to be quick spenders tending to hedonistic consumption; however, there is not much consensus on the generation's behavior. The question is, are Millennial consumers more prone to price sensitivity or ethical consumption of utilitarian products? The main objective of the empirical study was to explore Millennial utilitarian consumer behavior in reference to their degree of price sensitivity and ethical consumption, and preference to purchase from a firm engaged in corporate social responsibility (CSR). In order to do so, two models were developed, each focused on a different utilitarian product, to analyze Millennial consumer behavior regarding price sensitivity and ethical consumption. Results show that Mil-

lennial consumers are less price sensitive in regards to product attribute, and favor ethical consumption over price when CSR engagement is revealed.

López-Fernández, A. M. (2020). Price sensitivity versus ethical consumption: a study of Millennial utilitarian consumer behavior. *Journal of Marketing Analytics*, 8(2), 57-68. doi: 10.1057/s41270-020-00074-8. Article in Press.

Andrée Marie López Fernández

SNI Nivel I

STAKEHOLDER INFLUENCE ON DECISION MAKING: FROM E-MOVEMENTS (#METOO) TO CORPORATE SOCIAL RESPONSIBILITY POLICY

ABSTRACT. Firms that report engagement in corporate social responsibility strive for both business and social growth and development by being proactive in tending to stakeholders' needs and wants. In the midst of the #metoo movement, organizations around the world are confronted with the challenge of addressing current and potential stakeholders' online and offline demands to do the right thing, as well as maintain their right to operate. The question, then, is how does stakeholder voice via social networking sites influence organizational decision making? This study contributes to the understanding of stakeholders' role in the development of organizations' standards and policies, by exploring the legitimacy of organizations' engagement in corporate social responsibility in the midst of the #metoo movement. ©2020 The Author, Springer Nature Switzerland AG.

López-Fernández, A. M. (2019). Stakeholder influence on decision making: From e-movements (#metoo) to corporate social responsibility policy. In Rajagopal, B. R. (ed.), *Innovation, Technology, and Market Ecosystems: Managing Industrial Growth in Emerging Markets* (pp. 161-186). Cham, Switzerland: Palgrave Macmillan. doi: 10.1007/978-3-030-23010-4_8. Book Chapter.

Carlos Eduardo López Hernández

Investigador Titular B, SNI Nivel I

MARISA "FOR YOU, A TREAT"

ABSTRACT. Entrepreneurs, Strategic planning, Management, Family businesses. Study level/applicability: Undergraduate and Graduate (as an introductory case study). Case overview: Marisa® is a consolidated bakery in Guadalajara México, selling a wide variety of dessert products. It has achieved fast growth and has diversified with other brands, either by buying or developing them. Examples are Tía Lola® (economical cakes) and Dolce Natura® (artisanal ice creams). The company founder has

maintained not only the growth and development of her brand but also the organizational values and culture. These she has transmitted to her over 400 employees. The company is currently facing expansion. Expected learning outcomes: The expected learning outcomes are as follows: to distinguish the different expansion strategies; to discuss how to maintain culture and values in a firm despite time and growth; to analyze the current market and long-term objectives, as well as different competitors of the firm; and to make strategic decisions at the corporate level.

Lopez, C. E. (2018). MARISA 'For you, a treat'. *Emerald Emerging Markets Case Studies*, 8(2), 1-16. doi: 10.1108/EEMCS-08-2017-0190. Article.

Juan Enrique Núñez Ríos

SNI Nivel C

Manuel Soto Pérez

SNI Nivel C

Jacqueline Yvette Sánchez García

SNI Nivel C

Omar Guillermo Rojas Altamirano

Investigador Titular D, SNI Nivel I

A SYSTEMIC APPROACH TO SELF-MANAGEMENT IN SMES. CASE: MEXICAN LODGING ORGANISATIONS

ABSTRACT. Small and medium-sized lodging companies strongly depend on their collaborators to achieve their objectives and to be competitive. However, limitations in coordination and control mechanisms affect aspects such as primary operations, the self-management capability in the working teams and permanence in the sector previously mentioned. This article adopted the systemic approach, and under this perspective, qualitative and quantitative techniques were integrated. In this sense, the soft systems methodology was used to express a construct that suggests different relations as an alternative solution to the expressed problem. This construct was validated using partial least square path modelling. The results suggest that the proposed interactions can promote self-management in the companies under study. The implications of using the systemic approach require moving from a functionalist approach to an integral one while paying close attention to addressing human capital issues.

Núñez-Ríos J. E., Soto-Pérez M., Yvette Sánchez-García J., & Rojas O. G. (2020). A systemic approach to self-management in SMEs. Case: Mexican lodging organisations. *International Journal of Business Innovation and Research*, 22(4), 585-605. doi: 10.1504/IJBIR.2020.109038. Article.

Juan Enrique Núñez Ríos

SNI Nivel C

Jacqueline Yvette Sánchez García

SNI Nivel C

Omar Guillermo Rojas Altamirano

Investigador Titular D, SNI Nivel I

Elías Olivares Benítez

SNI Nivel I

FACTORS TO FOSTER ORGANIZATIONAL SUSTAINABILITY IN TOURISM SMES

ABSTRACT. Small and medium-sized tourism companies (SMEs) strongly depend on their collaborators to achieve competitiveness and sustainability. In this sense, these organizations need to identify those factors that help them to use their resources and efforts to achieve the aforementioned goals. This article proposes a model oriented to organizational sustainability in the tourism sector. A systemic approach was adopted to articulate this research; therefore, the soft systems methodology was applied to structure the problem and express a conceptual model that suggests relationships as an alternative solution to the expressed problem. Partial least squares path modeling was applied to statistically validate the relationships expressed in the construct. Results suggest that the relationships proposed in the construct are valid and may promote organizational sustainability. The ideas developed are restricted to the organizational domain and although the results apply in a Mexican context, this potential limitation can be offset by the multi-methodological approach proposed, extending the model's application to other types of organizations. This study may enable scholars and managers to improve communication and inter-organizational relationships, allowing organizations to focus their strategies and efforts using systems thinking to increase responsiveness and adaptation. © 2020 by the authors. Licensee MDPI, Basel, Switzerland.

Núñez-Ríos, J. E., Sánchez-García, J. Y., Rojas, O. G. & Olivares-Benítez, E. (2020). Factors to foster organizational sustainability in tourism smes. *Sustainability (Switzerland)*, 12(20), 1-21. doi: 10.3390/su12208657. Article.

Juan Enrique Núñez Ríos

SNI Nivel C

Jacqueline Yvette Sánchez García

SNI Nivel C

HUMAN CAPITAL MANAGEMENT IN TOURISM SMES FROM A CYBER-SYSTEMIC APPROACH

ABSTRACT. This article presents an approach to the problem that small and medium-sized Mexican

lodging enterprises face regarding their ability to adapt to changes in their context. Therefore, these organisations depend on their human capital to develop competitive advantages; however, their management is deficient, which makes their operations and their permanence in the market vulnerable. In this context, the management process of people is essential to encourage equilibrium within the organisation. Nevertheless, the literature review did not show any systemic models that are specific to these types of companies. The System of Systems Methodology supports this work; therefore, the Soft Systems Methodology is used to structure the problem and its components to propose a construct and outline a solution. The relevant systems of the construct are operationalised, and an analytical hierarchy process is used to make a comparison. Consistency values greater than 90% were obtained. This means that the model is congruent with the environment in which the mentioned organisations operate. Once the construct is validated, changes in the relationships of the studied companies are proposed based on the viable system model and the incorporation of cyber-systemic tenants that, together, contribute to solving the identified pathologies.

Núñez-Ríos, J. E., Sánchez-García, J. Y., & Tejeida-Padilla, R. (2020). Human Capital Management in Tourism SMEs from a Cyber-Systemic Approach. *Systemic Practice and Action Research*, 5(1), 527-559. doi: 10.1007/s11213-019-09499-4. Article.

Juan Enrique Núñez Ríos

SNI Nivel C

Jacqueline Yvette Sánchez García

SNI Nivel C

SYSTEMIC DESIGN FOR FOOD SELF-SUFFICIENCY IN URBAN AREAS

ABSTRACT. This article adopts a systemic approach to address the problem of the operationalization of relationships between actors conducive to food self-sufficiency in urban areas. Through the use of Social Network Analysis (SNA), the literature on urban agriculture was analyzed, detecting eight key trends and topic areas. This information was used to design a generic recursive organizational structure with the identification of the key roles and functions for management and governance in the multi-level and multi-stakeholder relationships of a sustainable urban self-sufficient food production system, inspired by the principles of complexity management and organizational cybernetics. Methodologically, this is the first application that combines the exploratory capability of SNA and the recursive structure of the Viable System Model (VSM) to propose applicable organizational structures in any urban area, suggesting a new route for the study and application of systemic

thinking in the development of urban agriculture schemes. However, due to the conceptual nature of this work, this study opens a discussion on how we can rethink interactions to seek continuous adaptation in food self-sufficiency, provide tools that foster inclusion, and adapt to every context to support the relevant actors and academics in urban agriculture.

Núñez-Ríos, J. E., Aguilar-Gallegos, N., Sánchez-García, J. Y., Cardoso-Castro, P. P. (2020). Systemic design for food self-sufficiency in urban areas. *Sustainability (Switzerland)*, 12(18). doi: 10.3390/su12187558. Article.

Adrián Ramírez Nafarrate

SNI Nivel II

ESTIMATION OF THE EXPECTED VALUE OF THE ARRIVAL EPOCHS GIVEN A BOUNDED PERIOD OF OBSERVATION FOR THE HOMOGENEOUS AND NON-HOMOGENEOUS POISSON PROCESSES

ABSTRACT. In this paper, we derive analytical expressions of the expected value of the arrival epochs given a bounded period of observation for the homogeneous Poisson process (HPP) and for the general case of a non-homogeneous Poisson process (NHPP). These expressions are exact, but their applicability require some computational adaptations. We illustrate the results obtained through the proposed expression by comparing them with Monte Carlo sampling. The results show that these expressions outperform Monte Carlo in precision and computational effort.

Gómez Márquez, H., Ramírez-Nafarrate, A., & López-Bracho, R. (2020). Estimation of the expected value of the arrival epochs given a bounded period of observation for the homogeneous and non-homogeneous Poisson processes. *Journal of Statistical Computation and Simulation*, 90(17), 3250-3259. doi: 10.1080/00949655.2020.1800707. Article in Press.

Adrián Ramírez Nafarrate

SNI Nivel II

EVALUATION OF PUBLIC HEI ON TEACHING, RESEARCH, AND KNOWLEDGE DISSEMINATION BY DATA ENVELOPMENT ANALYSIS

ABSTRACT. Governmental policies, such as educational ones, require money from taxes to implement them. Therefore, a government must spend its resources in such a way to maximise the benefits. However, to evaluate the Public Higher Education Institutions (P-HEI) is a very complex task since many factors that can be assessed are involved. In

this study, we focus on the performance of P-HEI in three activities: teaching, research, and knowledge dissemination. To accomplish this end, we develop a Data Envelopment Analysis Model to evaluate the efficiency of each activity, separately. Using an official database called EXECUM, we compute the efficiency of 40 Mexican P-HEI from year 2008–2016. The funds allocated for the government are an input in our study. According to our results, most P-HEIs are efficient in only one activity, while few are efficient in two activities. Only one P-HEI reached efficiency of 100% in the three models. On the other hand, 37.5% of the P-HEI do not reach 100% efficiency in any model. Our study provides the set of references for each P-HEI and the increments/decrements in the inputs and outputs to increase its efficiency.

Moncayo-Martínez, L. A., Ramírez-Nafarrate, A., & Hernández-Balderama M. G. (2019). Evaluation of public HEI on teaching, research, and knowledge dissemination by Data Envelopment Analysis. *Socio-Economic Planning Sciences*, 69. doi: 10.1016/j.seps.2019.06.003. Article in Press.

Adrián Ramírez Nafarrate

SNI Nivel II

THE IMPORTANCE OF WIDESPREAD TESTING FOR COVID-19 PANDEMIC: SYSTEMS THINKING FOR DRIVE-THROUGH TESTING SITES

ABSTRACT. On 11 March 2020, the World Health Organisation (WHO) declared COVID-19 a pandemic. Early epidemiological estimates show that COVID-19 is highly transmissible, infecting populations across the globe in a short amount of time. WHO has recommended widespread clinical testing in order to contain COVID-19. However, mass testing in emergency department (ED) settings may result in crowded EDs and increase transmission risk for healthcare staff and other ED patients. Drive-through COVID-19 testing sites are an effective solution to quickly collect samples from suspected cases with minimal risk to healthcare personnel and other patients. Nevertheless, there are many logistical and operational challenges, such as shortages of testing kits, limited numbers of healthcare staff and long delays for collecting samples. Solving these problems requires an understanding of disease dynamics and epidemiology, as well as the logistics of mass distribution. In this position paper, we provide a conceptual framework for addressing these challenges, as well as some insights from prior literature and experience on developing decision support tools for public health departments.

Araz, O. M., Ramírez-Nafarrate, A., Jehn, M., & Wilson, F. A. (2020). The importance of widespread testing for COVID-19 pandemic: systems thinking for drive-through testing sites. *Health Systems*, 9(2), 119-123. doi: 10.1080/20476965.2020.1758000. Article.

Adrián Ramírez Nafarrate

SNI Nivel II

Carlos Eduardo López Hernández

Investigador Titular B, SNI Nivel I

THE PASSPORT NIGHTMARE: BUSINESS PROCESS ANALYSIS IN PUBLIC SERVICE

ABSTRACT. Learning outcomes: Students should be able to: identify the elements of business processes; analyze efficiency measures; identify and define causes of poor efficiency in business process; analyze the results of a simulation model; propose process redesign alternatives based on the analysis; and acknowledge the challenges for improving public service processes. Case overview/synopsis: The process to get a passport seems to be very simple, but Jose Hernandez, a Manufacturing Plant Director, has had bad experiences the past three times he has visited the passport office. He and his family have spent more than 3 h to get the passport for his little daughter, Maria. In this case, the authors illustrate the process analysis performed by Jose to find effective and efficient solutions to the problems that he found. The case study guides students through the analysis of a business process in public service from the perspective of the users. The students participating in the case analysis will not only learn to diagnose and describe the process but also to redesign it to achieve significant improvements. Furthermore, the students will realize that adding more resources to the process may not solve the fundamental issues, but analytical and creative skills are needed. In addition, the teaching notes provide a discussion about the existing challenges to improve public service processes.

Ramírez-Nafarrate, A., López-Hernández, C. E. (2020). The passport nightmare: business process analysis in public service. *Emerald Emerging Markets Case Studies*, 10(2), 1-24. doi: 10.1108/EEMCS-12-2019-0338. Article.

Román Rodríguez Aguilar

SNI Nivel II

José Antonio Marmolejo Saucedo

SNI Nivel II

A HYBRID MODEL FOR IMPROVING THE PERFORMANCE OF BASKETBALL LINEUPS

ABSTRACT. An optimization model of the NBA team lineups is presented to improve the performance of the teams according to the selected lineup. A set of variables such as inputs and out-

come variables are taken into account to optimize the results. Additionally, a technical efficiency analysis was performed on the performance of the lineups selected by the optimization model to validate the results. The results show that the lineups selected through the optimization model were those with greater technical efficiency for the equipment. The application of optimization methods and technical efficiency can be a robust tool for decision making in the sports field. © Springer Nature Switzerland AG 2020.

Rodríguez-Aguilar, R., Infante-Escudero, R., & Marmolejo-Saucedo, J. A. (2020). A hybrid model for improving the performance of basketball lineups. In Vasant, P., Litvinchev, I. Marmolejo-Saucedo, J. A., Rodríguez-Aguilar, R. Martínez-Ríos, F. (eds.), *Data Analysis and Optimization for Engineering and Computing Problems: Proceedings of the 3rd EAI International Conference on Computer Science and Engineering and Health Services* (pp. 61-71). Cham, Switzerland: Springer. doi: 10.1007/978-3-030-48149-0_5. Book Chapter.

Román Rodríguez Aguilar

SNI Nivel II

A HYBRID MODEL TO SIMULATE TEST CASES OF ELECTRICAL POWER SYSTEMS

ABSTRACT. The development of solution algorithms for power system problems is based on hypothetical test systems and test cases. These systems are very scarce, and the degree of variability is relatively low. The constant development of the economic analysis in electrical power systems denotes the need to obtain standardized systems and cases. In this study, the creation of standardized test cases based on a hybrid model using Levy alpha stable distributions and generalized additive models is proposed. The objective of the work is to present a methodological proposal for the creation of test environments for optimization models based on general information about the operation of particular power systems. The simulation of random values based on Levy alpha stable distributions lets capturing the series impulsivity and demand peaks, and the use of generalized additive models permits capturing non-linearity in the behavior of the demand for electrical energy. The hybrid model will tolerate simulating as many instances as necessary, with a coherent behavior attached to the reality of the operation of the analyzed electrical systems.

Rodríguez-Aguilar, R. (2020). A hybrid model to simulate test cases of electrical power systems. *Applied Sciences (Switzerland)*, 10(10). doi: 10.3390/app10103531. Article.

Román Rodríguez Aguilar

SNI Nivel II

AN ANALYTICAL INTELLIGENCE MODEL FOR THE MANAGEMENT OF RESOURCES FOR THE TREATMENT OF HIGH-COST DISEASES: THE CASE OF HIV IN MEXICO

ABSTRACT. In the health sector, it is very important to have adequate control over the allocation of resources; this becomes much more relevant in the case of high-cost diseases, HIV is one example of this. The use of analytical intelligence allows the transformation of raw data into meaningful and useful information to make decisions. To support the management of resources in the health sector an analytical intelligence model based on survival analysis of patients under antiretroviral treatment in the Ministry of Health of Mexico is proposed. A survival model was carried out using a cohort of people with HIV under antiretroviral treatment attended by the Ministry of Health for the period 2007–2015. Sociodemographic variables, viral load, dates of treatment initiation and death were used. Kaplan–Meier method and the logarithmic rank test, as well as the Cox proportional-hazard model, were used. The proposed model can serve as a strategic information management tool for decision-making about the care and financing of high-cost diseases in the health sector. The results show that the probability of survival in people with HIV is higher for currently preferred treatments for treatment initiation and recently incorporated. Increasing the level of CD4 for the start of treatment generates greater probabilities of survival for patients. It is necessary to comprehensively evaluate the prescription and initiation of treatment policies according to CD4 levels to guarantee the financial sustainability of antiretroviral treatment in the Ministry of Health since these measures imply greater use of resources. It would be helpful to implement this type of analytical intelligence model for the monitoring and management of resources in the health sector.

Rodríguez-Aguilar, R. & Rivera-Peña, G. (2020). An analytical intelligence model for the management of resources for the treatment of high-cost diseases: the case of HIV in Mexico. *Wireless Networks*, 26(8), 5825–5834. doi: 10.1007/s11276-020-02311-5. Article in Press.

Román Rodríguez Aguilar

SNI Nivel II

DEMAND PREDICTION USING A SOFT-COMPUTING APPROACH: A CASE STUDY OF AUTOMOTIVE INDUSTRY

ABSTRACT. According to the literature review performed, there are few methods focused on the study of qualitative and quantitative variables when making

demand projections by using fuzzy logic and artificial neural networks. The purpose of this research is to build a hybrid method for integrating demand forecasts generated from expert judgements and historical data and application in the automotive industry. Demand forecasts through the integration of variables; expert judgements and historical data using fuzzy logic and neural network. The methodology includes the integration of expert and historical data applying the Delphi method as a means of collecting fuzzy data. The result according to proposed methodology shows how fuzzy logic and neural networks is an alternative for demand planning activity. Machine learning techniques are techniques that generate alternatives for the tools development for demand forecasting. In this study, qualitative and quantitative variables are integrated through the implementation of fuzzy logic and time series artificial neural networks. The study aims to focus in manufacturing industry factors in conjunction time series data.

Salais-Fierro, T. E., Saucedo-Martínez, J. A., Rodríguez-Aguilar, R., & Vela-Haro, J. M. (2020). Demand prediction using a soft-computing approach: A case study of automotive industry. *Applied Sciences (Switzerland)*, 10(3). doi: 10.3390/app10030829. Article.

Román Rodríguez Aguilar

SNI Nivel II

OPTIMAL CONSUMPTION DECISIONS OF FAMILY NETWORKS WITH SIMILAR FELICITY FUNCTIONS

ABSTRACT. Family networks have increased at an accelerated pace through social networking through social networking services, online platforms, and social media clubs. This paper develops a model of an economy populated by networks of families with similar preferences (the same functional form of the felicity or utility function) but family members differ in their deep parameters (compulsion for consumption and risk tolerance), which, in turn, leads to some kind of heterogeneity among the families. In this context, the problem of felicity (utility) maximization of the average family in the network is solved. The optimal path of consumption is obtained for the average family and graphical comparative static exercises are performed. Finally, the economic welfare of the typical family in a network is calculated and comparative static experiments are carried out. This approach improves the understanding of the consumption decision making of families interacting in social networking services.

Palafox-Roca, A. O., Rodríguez-Aguilar, R., Castillo-Ramírez, C. E., & Venegas-Martínez, F. (2020). Optimal consumption decisions of family networks with similar felicity functions. *Wireless Networks*, 26(8), 5703–5712. doi: 10.1007/s11276-019-02063-x. Article.

Román Rodríguez Aguilar

SNI Nivel II

MAIN METRIC COMPONENTS IN THE GENERATION OF MIXED INDICATORS: AN APPLICATION OF SGVD METHODOLOGY

ABSTRACT. The analysis of mixed principal components is presented by applying the generalized singular value decomposition methodology (GSVD). This multivariate analysis allows quantitative and qualitative analysis, combining principal component analysis with multiple correspondence analysis. The GSVD methodology is developed and applied to the data of the national survey of household income and expenditure in Mexico for the period 2016. The objective is to build an indicator of consumption patterns of Mexican households through a set of variables that consider sociodemographic aspects of households (qualitative) as well as variables that interest consumption items of households (quantitative). The results show that the indicator generated by mixed main components allows characterizing sets of households according to their sociodemographic characteristics and consumption patterns. This indicator allows a comprehensive evaluation of household profiles according to interest consumption items and defined sociodemographic variables. The results are presented by applying the Varimax rotation, which allows a better interpretation of the mixed main components generated.

Rodríguez-Aguilar, R. (2020). Main Metric Components in the Generation of Mixed Indicators: An Application of SGVD Methodology. *EAI/Springer Innovations in Communication and Computing* (pp. 195-206). Cham, Switzerland: Springer. doi: 10.1007/978-3-030-48149-0_14. Book Chapter.

Román Rodríguez Aguilar

SNI Nivel II

PROPOSAL FOR A COMPREHENSIVE ENVIRONMENTAL KEY PERFORMANCE INDEX OF THE GREEN SUPPLY CHAIN

ABSTRACT. The consideration of environmental objectives in the design of green supply chains creates the need to build a set of key performance indicators for monitoring and control. There is a set of generally accepted environmental indicators for monitoring environmental objectives in the supply chain. However, so far these indicators have been disconnected from the operational and economic indicators of the supply chain. It is important to consider these elements in the integral performance of a green supply chain. The present work is a proposal of a general index of environmental performance that includes operational, financial, and environmental aspects that allow monitoring the integral performance of the supply chain by applying Principal Component Analysis of mixed data.

Rodríguez-Aguilar, R. (2020). Proposal for a Comprehensive Environmental Key Performance Index of the Green Supply Chain. *Mobile Networks and Applications*, 25(6), 2161-2171. doi: 10.1007/s11036-020-01559-7. Article in Press.

Román Rodríguez Aguilar

SNI Nivel II

José Antonio Marmolejo Saucedo

SNI Nivel II

STRUCTURAL DYNAMICS AND DISRUPTION EVENTS IN SUPPLY CHAINS USING FAT TAIL DISTRIBUTIONS

ABSTRACT. The analysis of structural dynamics in a supply chain requires robust methods for the modeling of disruption events that can be faced. Statistical modeling, the machine learning application and access to large amounts of data require much more realistic models to manage risk in the supply chain. This study proposes a statistical methodology for the modeling of disruption events in the supply chain with heavy tailed distributions, which will allow the construction of models more closely linked to reality for risk management in the supply chain. © 2019, IFAC (International Federation of Automatic Control) Hosting by Elsevier Ltd. All rights reserved.

Rodríguez-Aguilar, R. & Marmolejo-Saucedo, J. A. (2019). Structural Dynamics and disruption events in Supply Chains using Fat Tail Distributions. *IFAC-PapersOnLine*, 52(13), 9th IFAC Conference on Manufacturing Modeling, Management and Control MIM 2019 (Germany), Berlin 2704-2709. doi: 10.1016/j.ifacol.2019.11.613. Conference Paper.

Omar Guillermo Rojas Altamirano

Investigador Titular D, SNI Nivel I

A BAYESIAN STUDY OF CHANGES IN VOLATILITY OF BITCOIN

[UN ESTUDIO BAYESIANO DE LOS CAMBIOS DE VOLATILIDAD DEL BITCOIN]

ABSTRACT. This paper is aimed at studying MS-GARCH model applied at Bitcoin. A Bayesian estimation of the model shows that Bitcoin's volatility can be modelled using two states of volatility, high and low. The modelled volatility is not stable over time. Twenty eight periods of high volatility were found, the largest period of volatility occurred during 2013. The findings help explain what happened during this high volatility periods.

Rojas, O. & Coronado, S. (2020). A Bayesian study of changes in volatility of Bitcoin [Un estudio Bayesiano de los cambios de volatilidad del Bitcoin]. *Contaduría y Administración*, 65(3). doi: 10.22201/fca.24488410e.2020.2358. Article.

Omar Guillermo Rojas Altamirano

Investigador Titular D, SNI Nivel I

Guillermo Sosa Gómez

Profesor investigador

BIT INDEPENDENCE CRITERION EXTENDED TO STREAM CIPHERS

ABSTRACT. The bit independence criterion was proposed to evaluate the security of the S-boxes used in block ciphers. This paper proposes an algorithm that extends this criterion to evaluate the degree of independence between the bits of inputs and outputs of the stream ciphers. The effectiveness of the algorithm is experimentally confirmed in two scenarios: random outputs independent of the input, in which it does not detect dependence, and in the RC4 ciphers, where it detects significant dependencies related to some known weaknesses. The complexity of the algorithm is estimated based on the number of inputs l , and the dimensions, n and m , of the inputs and outputs, respectively.

Madarro-Capó E. J., Legón-Pérez C. M., Rojas O., Sosa-Gómez G., & Socorro-Llanes R. (2020). Bit independence criterion extended to stream ciphers. *Applied Sciences (Switzerland)*, 10(21), 1-19. doi: 10.3390/app10217668. Article.

Omar Guillermo Rojas Altamirano

Investigador Titular D, SNI Nivel I

Guillermo Sosa Gómez

Profesor investigador

MEASURING INDEPENDENCE BETWEEN STATISTICAL RANDOMNESS TESTS BY MUTUAL INFORMATION

ABSTRACT. The analysis of independence between statistical randomness tests has had great attention in the literature recently. Dependency detection between statistical randomness tests allows one to discriminate statistical randomness tests that measure similar characteristics, and thus minimize the amount of statistical randomness tests that need to be used. In this work, a method for detecting statistical dependency by using mutual information is proposed. The main advantage of using mutual information is its ability to detect nonlinear correlations, which cannot be detected by the linear correlation coefficient used in previous work. This method analyzes the correlation between the battery tests of the National Institute of Standards and Technology, used as a standard in the evaluation of randomness. The results of the experiments show the existence of statistical dependencies between the tests that have not been previously detected.

Karell-Albo, J. A., Legón-Pérez, C. M., Madarro-Capó, E. J., Rojas, O., & Sosa-Gómez, G. (2020). Measuring independence between statistical randomness tests by mutual information. *Entropy*, 22(7). doi: 10.3390/e22070741. Article.

Omar Guillermo Rojas Altamirano

Investigador Titular D, SNI Nivel I

TIME-VARYING SPILLOVERS BETWEEN CURRENCY AND STOCK MARKETS IN THE USA: HISTORICAL EVIDENCE FROM MORE THAN TWO CENTURIES

ABSTRACT. In this paper, we analyze time-varying causality between the dollar-pound exchange rate and S&P 500 return over the monthly period of September, 1791 to September, 2019. Based on a Dynamic Conditional Correlation-Multivariate Generalised Autoregressive Conditional Heteroskedasticity (DCC-MGARCH) framework, we find that evidence of unidirectional causality between the two returns is in general weak, and primarily restricted to the period following the breakdown of the Bretton Woods agreement. However, instantaneous spillovers across the returns of these two markets is quite strong, which in turn tends to suggest the existence of nonsynchronous trading and also high-frequency causal dependency, with the latter confirmed based on daily data covering 3 January 1900 - 4 October 2019. Moreover, the underlying DCC reveals that there is actually portfolio diversification opportunities for investors. Finally, an analysis of the second moments reveal much stronger evidence of volatility spillovers between these two assets, when compared to the return linkages. This result has important implications from the perspective of policy making aiming to reduce the impact of uncertainty on the real economy.

Coronado S., Gupta R., Hkiri B., & Rojas O. (2020). Time-varying spillovers between currency and stock markets in the USA: Historical evidence from more than two centuries. *Advances in Decision Sciences*, 24(4). doi: 10.47654/V24Y2020I4P44-76. Review.

Jacqueline Yvette Sánchez García

SNI Nivel C

Juan Enrique Núñez Ríos

SNI Nivel C

Manuel Soto Pérez

SNI Nivel C

Alejandro Rodríguez Magaña

Investigador Titular A, SNI Nivel C

A SYSTEMS SCIENCE APPROACH TO INTER-ORGANISATIONAL COMPLEMENTARITY IN TOURISM SMES

ABSTRACT. This article proposes a model based on the integration of systemic mechanisms such as the soft systems methodology, partial least squares path modelling and the viable system model as an alternative for fostering complementarity (associativity) in Small and Medium Enterprises to improve

responsiveness and adaptations in the tourism sector. The systemic method was adopted as a framework for the proposal. In this regard: 1. The soft systems methodology was used to frame the problem and propose a construct for outlining a possible solution; the methodology included a questionnaire applied to 150 actors (including SME owners and managers and government officials). 2. Partial least squares path modelling was used to statistically validate the relationships in the construct. 3. Through the viable system model, the interactions between SMEs were reconsidered to recognise contextual impacts and foster complementarity. The goodness of fit of 70% obtained for the conceptual model suggests that complementarity, as an organisational form, is possible. The soft systems perspective is considered suitable because it deals with the complex nature of the problem (SME associativity). Although the results in this study apply to the Mexican context, we suggest that this potential limitation can be offset by the multi-methodological approach proposed here, allowing the model's application to all kinds of organisations. Hence, the observations in this paper are constrained to the organisational domain. This study may enable scholars and managers to improve communication channels as well as inter-organisational relationships, emphasising the increase in the responsiveness and adaptation capabilities to facilitate associativity between SMEs in the studied sector.

Sánchez-García, J. Y., Núñez-Ríos, J. E., Soto-Pérez, M., Cardoso-Castro, P. P., & Rodríguez-Magaña, A. (2019). A Systems Science Approach to Inter-Organisational Complementarity in Tourism SMEs. *Systemic Practice and Action Research*, 33(1). doi: 10.1007/s11213-019-09512-w. Article in Press.

Germán Roberto Scalzo Molina

SNI Nivel I

EDUCATIONAL IMPLICATIONS THAT ARISE FROM DIFFERING MODELS OF HUMAN DEVELOPMENT AND THEIR REPERCUSSIONS ON SOCIAL INNOVATION

ABSTRACT. Social innovation aims for creating social value primarily while it recognizes that not all technology-based progress amounts to social progress. We think that this calls for a paradigm shift in how we understand education. No one doubts that education requires intense cognitive effort, but educational proposals certainly vary depending on how cognition is understood. In this article, we suggest that different ways of understanding human development are related to different ways of understanding cognition. Thus, these different conceptions of human development affect their resulting educational proposal. While not an exhaustive account, we sketch out three models of human development, the so-called autonomous self (AS), processual self (PS), and inter-processual self (IPS). Each has different implications for education depending

on their particular understanding of cognition. The AS and PS models understand cognition as a primarily rational mastery exercise, with the difference that PS uses relationships and diverse psychological faculties for the subject's cognitive development, whereas AS relies more on the subject's rational agency. On the other hand, IPS understands cognition as a relational act that, when it arises from interiority, affects all dimensions of the person. In the present article, we explore the educational consequences of these different ways of understanding cognition with the assistance of interdisciplinary dialogue from philosophy, psychology, and neuroscience, and their repercussion on social innovation with the intention of opening up reflection in the field of education and of inspiring its practitioners to rethink the model they assume. We will conclude with reflections informing educational implications for the design of programs and teacher training itself.

Orón Semper, J. V., Akrivou, K., & Scalzo, G. (2019). Educational Implications That Arise From Differing Models of Human Development and Their Repercussions on Social Innovation. *Frontiers in Education*, 4(16). doi: 10.3389/educ.2019.00139. Article.

Germán Roberto Scalzo Molina

SNI Nivel I

IN SEARCH OF A FITTING MORAL PSYCHOLOGY FOR PRACTICAL WISDOM: EXPLORING A MISSING LINK IN VIRTUOUS MANAGEMENT

ABSTRACT. While business as a social activity has involved communities of persons embedded in dense relational networks and practices for thousands of years, the modern legal, theoretical psychological, and moral foundations of business have progressively narrowed our understanding of practical wisdom. Although practical wisdom has recently regained ground in business ethics and management studies, thanks mainly to Anscombe's recovery of virtue ethics, Anscombe herself once observed that it lacks, and has even neglected, a moral psychology that genuinely complements the nuanced philosophical perspective of a virtue-centered moral philosophy. Herein, we offer one way to fill this gap by suggesting two opposing psychological paradigms, namely the inter-processual self and the autonomous self, which are classified according to the assumptions they make about the self, human agency and action more broadly, as well as how they relate to practical wisdom. Upon presenting these moral psychologies, we will bring this proposal into conversation with business ethics to show how the IPS paradigm can enable and support virtuous management.

Akrivou, K. & Scalzo, G. (2020). In search of a fitting moral psychology for practical wisdom: Exploring a missing link in virtuous management. *Business Ethics*, 29(S1), 33-44. doi: 10.1111/beer.12295. Article.

Germán Roberto Scalzo Molina

SNI Nivel I

THE SCHOOL OF SALAMANCA ACCORDING TO JOSÉ BARRIENTOS: ITS ORIGIN, DISSEMINATION AND INTELLECTUAL IMPACT IN EUROPE (XVI-XVIII CENTURIES)

[LA ESCUELA DE SALAMANCA SEGÚN JOSÉ BARRIENTOS: ORIGEN, DIFUSIÓN E IMPACTO INTELECTUAL EN EUROPA (SIGLOS XVI AL XVIII)]

ABSTRACT. A diversity of opinions concerning what the School of Salamanca is flourish in contemporary academic literature, and interest in its study has notably increased. This paper offers a systematic analysis of the sixteenth to eighteenth-century authors that Jose Barrientos presents in his work *Repertorio de moral económica* (1536-1670): *La Escuela de Salamanca y su proyección* (EUNSA, 2011). A study of the information that Barrientos provides –including years of edition of the different works, the places of publication, variations in the cited authors, the religious orders to which their authors belong and the central themes discussed– aims to show the rise and decline of the School, and its importance for the West's economic and political history. It concludes that the School of Salamanca's efforts were the first attempt to configure specialized and systematic thought about economic and social problems starting from the medieval tradition and up to Renaissance humanism.

Scalzo G. & Almarcegui A. M. (2020). The School of Salamanca According to José Barrientos: Its Origin, Dissemination and Intellectual Impact in Europe (XVI-XVIII Centuries) [La escuela de salamanca según José Barrientos: origen, difusión e impacto intelectual en europa (siglos XVI al XVIII)]. *Cauriensia*, 15, 279-299. doi: 10.17398/2340-4256.15.279. Article.

Manuel Soto Pérez

SNI Nivel C

Jacqueline Yvette Sánchez García

SNI Nivel C

Juan Enrique Núñez Ríos

SNI Nivel C

FACTORS TO IMPROVE JOB PERFORMANCE AND SCHOOL EFFECTIVENESS

ABSTRACT. Purpose: Identify some of the most relevant factors that trigger a private school's workforce to foster a sustainable competitive advantage by reinforcing the intrinsic job satisfaction and the levels of teacher self-efficacy, engagement and job performance. Design/methodology/approach: Surveys were applied to private school teachers to assess their per-

ception concerning the studied variables, data were tested at a confirmatory level using the partial least squares path modelling (PLS-PM). Findings: Teachers with a high sense of self-efficacy and possessing elevated intrinsic satisfaction tend to be highly productive and results-oriented. Intrinsic job satisfaction is a key factor that influences more than extrinsic job satisfaction in the previously mentioned relationship. Research limitations/implications: Although the obtained results are constrained and apply to the Mexican context, we suggest that virtual limitation can be overcome by extending the study due to the proposed construct that can be applied in other regions or organizations. Practical implications: Principals will need to develop mainly the intrinsic job satisfaction in the teaching staff, to improve the job and organizational performance. This should be accompanied, secondly, by factors that encourage extrinsic satisfaction such as fair pay or recognition. Originality/value: Open up an alternative explanation, based on the evidence of this study, to the theory of social exchange, since the factor that most influences teacher's citizenship behaviours is not extrinsic but intrinsic satisfaction. That is, it is not what the employee receives from the institution, but what the employee does or gives to the institution the source of satisfaction that will encourage greater job performance. © 2020, Emerald Publishing Limited.

Soto-Pérez, M., Sánchez-García, J. Y., & Núñez-Ríos, J. E. (2021). Factors to improve job performance and school effectiveness. *International Journal of Educational Management*, 34(5), 805-822. doi: 10.1108/IJEM-07-2019-0237. Article.

Guillermo Sosa Gómez

Profesor investigador

A MODIFIED MULTIFRACTAL DETRENDED FLUCTUATION ANALYSIS (MFDFA) APPROACH FOR MULTIFRACTAL ANALYSIS OF PRECIPITATION

ABSTRACT. Multifractal Detrended Fluctuation Analysis (MFDFA) is an efficient method to investigate the long-term correlations of the power law of non-stationary time series, in which the elimination of local trends usually depends upon a fixed-constant polynomial order. In this paper, we propose a flexible set of polynomial and trigonometric functions to better detect, and correctly model, hidden local trends in the time series at different scales. We introduce the Multifractal Detrended Fluctuation Analysis with Polynomial and Trigonometric functions (MFDFAPT) method via optimal model selection from an optimization framework. The performance of MFDFAPT is assessed with extensive numerical experiments based on the multifractal binomial cascade process, fractional Brownian movements, and fractional Gaussian noises. MFDFAPT shows better performance than MFDFA in the approximation of the Hurst index, and cor-

rectly determines the scalar behavior in stationary and non-stationary series. Additionally we apply MFDFA to detect and characterize the scalar properties of the daily precipitation time series in meteorological stations of Tabasco, México. Our results confirm previous indications that the general Hurst exponent depends on the physiographic characteristics of the study area, and that fractal dimension correctly characterizes the series of daily precipitations in tropical regions.

Morales Martínez J. L., Segovia-Domínguez, I., Rodríguez, I. Q., Horta-Rangel, F. A., & Sosa-Gómez, G. (2021). A modified Multifractal Detrended Fluctuation Analysis (MFDFA) approach for multifractal analysis of precipitation. *Physica A: Statistical Mechanics and its Applications*, 565(1). doi: 10.1016/j.physa.2020.125611. Article.

Guillermo Sosa Gómez

Profesor investigador

Omar Guillermo Rojas Altamirano

Investigador Titular D, SNI Nivel I

ALGORITHM TO DETECT AND CALCULATE THE CEREBROSPINAL FLUID (CSF) THROUGH MAGNETIC RESONANCE IMAGING (MRI)

ABSTRACT. INTRODUCTION: An heuristic algorithm for detection and segmentation of cerebrospinal fluid through magnetic resonance imaging is presented. **OBJECTIVE:** The objective of the method is to calculate the minimum amount of anesthesia to be used in patients at the time of an operation and thus make a decision based on the algorithm. **METHODS:** The pattern-based CSF segmentation algorithm presented is based on finite cellular automata that takes as input light and dark images obtained from MRI methods. **RESULTS:** Based on Fieldman's test, results show that the algorithm is as efficient as the decision taken by two different operators regarding the mL of anesthesia to be used in the patient.

González-Martín, E., Sosa-Gómez, G., & Rojas, O. (2020). Algorithm to detect and calculate the cerebrospinal fluid (CSF) through magnetic resonance imaging (MRI). *EAI Endorsed Transactions on Pervasive Health and Technology*, 5(20). doi: 10.4108/ea1.13-7-2018.164179. Article.

Guillermo Sosa Gómez

Profesor investigador

Omar Guillermo Rojas Altamirano

Investigador Titular D, SNI Nivel I

AN APPLICATION OF HADAMARD TRANSFORM TO TEST STREAM CIPHERS

ABSTRACT. In this chapter, we discuss results obtained on an application of the Hadamard transform to crypt-

analysis, and in particular, we determine the probability to decipher different pseudo-random number generators used as components of stream ciphers.

Sosa-Gómez G., Rojas O., & Páez-Osuna O. (2020). An Application of Hadamard Transform to Test Stream Ciphers. In Vasant, P., Litvinchev. I. Marmolejo-Saucedo. J. A., Rodríguez-Aguilar, R. Martínez-Ríos, F. (eds.), *Data Analysis and Optimization for Engineering and Computing Problems: Proceedings of the 3rd EAI International Conference on Computer Science and Engineering and Health Services* (pp. 255-262). Cham, Switzerland: Springer. doi: 10.1007/978-3-030-48149-0_19. Book Chapter.

Guillermo Sosa Gómez

Profesor investigador

Omar Guillermo Rojas Altamirano

Investigador Titular D, SNI Nivel I

AN HEURISTIC ALGORITHM TO CALCULATE THE MINIMUM AMOUNT OF ANESTHESIA USING MRI

ABSTRACT. In this work, we introduce a heuristic segmentation algorithm for the detection and subsequent segmentation of the volume of cerebrospinal fluid (CSF) that allows from MRI to calculate the CSF due to the importance of this represents to calculate the amount of anesthesia to be used in patients.

González-Martín E., Sosa-Gómez G., & Rojas O. (2020). An Heuristic Algorithm to Calculate the Minimum Amount of Anesthesia Using MRI. In Vasant, P., Litvinchev. I. Marmolejo-Saucedo. J. A., Rodríguez-Aguilar, R. Martínez-Ríos, F. (eds.), *Data Analysis and Optimization for Engineering and Computing Problems: Proceedings of the 3rd EAI International Conference on Computer Science and Engineering and Health Services* (pp. 27-38). Cham, Switzerland: Springer. doi: 10.1007/978-3-030-48149-0_3. Book Chapter.

Guillermo Sosa Gómez

Profesor investigador

Omar Guillermo Rojas Altamirano

Investigador Titular D, SNI Nivel I

EVOLVING NONLINEAR S-BOXES WITH IMPROVED THEORETICAL RESILIENCE TO POWER ATTACKS

ABSTRACT. Substitution boxes are the main nonlinear component of block ciphers. The security of these ciphers against linear, differential, or side-channel attacks is dependent on the design of such component and their intrinsic properties. There are several methods that aim to cryptographically define, generate, or search for strong sub-

stitution boxes. The application of combinatorial optimization algorithms is one of the most useful methodologies in this research area. In this article, we present a novel hybrid method based on the Leaders and Followers and hill-climbing over Hamming Weight Classes metaheuristics, coupled with a new trade-off fitness function that generates 8-bit bijective substitution boxes with good resisting properties towards classical cryptanalysis and side-channel attacks by power consumption. We address the best Pareto optimal solutions for the multi-objective optimization of non-linearity and confusion coefficient variance.

Freyre-Echevarría, A., Martínez-Díaz, I., Pérez, C. M. L., Sosa-Gómez, G., & Rojas O. (2020). Evolving Nonlinear S-Boxes With Improved Theoretical Resilience to Power Attacks. *IEEE Access*, 8, 202728-202737. doi: 10.1109/ACCESS.2020.3035163. Article.

Guillermo Sosa Gómez

Profesor investigador

Omar Guillermo Rojas Altamirano

Investigador Titular D, SNI Nivel I

METAHEURISTICS IN THE OPTIMIZATION OF CRYPTOGRAPHIC BOOLEAN FUNCTIONS

ABSTRACT. Generating Boolean Functions (BFs) with high nonlinearity is a complex task that is usually addresses through algebraic constructions. Metaheuristics have also been applied extensively to this task. However, metaheuristics have not been able to attain so good results as the algebraic techniques. This paper proposes a novel diversity-aware metaheuristic that is able to excel. This proposal includes the design of a novel cost function that combines several information from the Walsh Hadamard Transform (WHT) and a replacement strategy that promotes a gradual change from exploration to exploitation as well as the formation of clusters of solutions with the aim of allowing intensification steps at each iteration. The combination of a high entropy in the population and a lower entropy inside clusters allows a proper balance between exploration and exploitation. This is the first memetic algorithm that is able to generate 10-variable BFs of similar quality than algebraic methods. Experimental results and comparisons provide evidence of the high performance of the proposed optimization mechanism for the generation of high quality BFs.

López-López I., Sosa-Gómez G., Segura C., Oliva D., & Rojas O. (2020). Metaheuristics in the optimization of cryptographic boolean functions. *Entropy*, 22(9). doi: 10.3390/E22091052. Article.

Guillermo Sosa Gómez

Profesor investigador

Omar Guillermo Rojas Altamirano

Investigador Titular D, SNI Nivel I

USING HADAMARD TRANSFORM FOR CRYPTANALYSIS OF PSEUDO-RANDOM GENERATORS IN STREAM CIPHERS

ABSTRACT. In this work we discuss results obtained from an application of the Hadamard transform to cryptanalysis, and in particular, we determine the probability to decipher different pseudo-random number generators used as components of stream ciphers. Also, we found a relationship between entropy and Hadamard's values.

Sosa-Gómez, G., Rojas, O., & Páez-Osuna, O. (2020). Using hadamard transform for cryptanalysis of pseudo-random generators in stream ciphers. *EAI Endorsed Transactions on Energy Web*, 7(27). Article.

Edgar Demetrio Tovar García

Investigador Titular D, SNI Nivel II

DETERMINANTS OF MEXICO'S BILATERAL TRADE BALANCE: INCOME, EXCHANGE RATE, AND EXPORT COMPOSITION

[DETERMINANTES DEL BALANCE COMERCIAL BILATERAL DE MÉXICO: INGRESO, TIPO DE CAMBIO Y COMPOSICIÓN DE LAS EXPORTACIONES]

ABSTRACT. Using dynamic panel data models, this paper studies the determinants of Mexico's bilateral trade balance with 39 trade partners from 1990 to 2016. The literature points to income and real exchange rate as key independent variables. This study includes export composition as an explanatory variable (a previously neglected aspect). Results differ from other researches: there is no robust evidence on the effect of income; there is evidence of the association between bilateral balance and real exchange rate; and there is a weak positive link with exports consisting of high-tech goods, partially explaining Mexico's persistent trade deficit.

Carrasco, C. A., Tovar-García, E. D. (2020). Determinants of Mexico's bilateral trade balance: Income, exchange rate, and export composition [Determinantes da balança comercial bilateral mexicana: Renda, taxa de câmbio e composição das exportações]. *Revista Finanças y Política Económica*, 11(2), 259-276. doi: 10.14718/REVFINANZPOLITECON.2019.11.2.3. Article.

Edgar Demetrio Tovar García

Investigador Titular D, SNI Nivel II

EXPORT COMPOSITION AND THE EUROZONE TRADE BALANCE IN MANUFACTURING GOODS

ABSTRACT. Some Eurozone countries have been characterised by a persistently increasing trend in the external imbalances, involving potential risks. This research is pioneering in analysing the effects of export composition on the trade balance in manufacturing goods using bilateral trade flows among the EA-12 countries and their EU-15 partners. Based on dynamic panel data regression models, the results indicated a robust association between the share of high-technology export goods and the trade balance. This association is robust during the period of growing imbalances (1999-2007) and for an expanded time span (1999-2015). In contrast to previous studies, traditional explanatory variables such as income elasticity and price elasticity did not show significant associations. Therefore, the policy makers need to be aware that the economic specializations of their countries, especially their export structures, play key roles in explaining and managing the external imbalances.

Carasco, C. A. & Tovar-García, E. D. (2020). Export composition and the eurozone trade balance in manufacturing goods. *Romanian Journal of Economic Forecasting*, 23(1), 134-150. Article.

Edgar Demetrio Tovar García

Investigador Titular D, SNI Nivel II

NEVER MARRIED AND EARNINGS: EVIDENCE FROM RUSSIA

ABSTRACT. Purpose: The purpose of this paper is to examine the effect of civil status on wage earnings in post-Soviet Russia. Education and work experience are the key explanatory variables according to the Mincer function. In view of that, here, an extension of the Mincer equation is estimated, focusing on never married individuals versus other civil status (married people). Thus, testing the female wage penalty and the male wage premium hypotheses. Design/methodology/approach: This study is based on dynamic panel data models, underlining the autoregressive nature of earnings, controlling for time-invariant independent variables and adding marriage as an explanatory variable. The models are estimated using longitudinal data over the years 2000-2017, taken from the Russia Longitudinal Monitoring Survey. Findings: The results indicate that never married Russians do not obtain

higher levels of wage earnings in comparison with those who are married or correspond to other civil status. However, there is evidence supporting a wage premium for men and weak evidence of a penalty for women. That is, the regression results indicate a wage penalty for never married men and a wage premium for never married women, yet this last finding is not robust. Therefore, the general findings of this research only partially agree with the most recent evidence in developed countries, where marriage is not anymore associated with wages. Originality/value: These findings are highly relevant for public policies related to family development, a major concern for the Russian Government during the last two decades. There is a common idea that avoiding marriage is associated with intentions to obtain higher levels of earnings, but this is a problem of myopia.

Tovar-García E. D. (2020). Never married and earnings: evidence from Russia. *International Journal of Social Economics*, 47(12), 1513-1526. doi: 10.1108/IJSE-10-2019-0606. Article.

Edgar Demetrio Tovar García

Investigador Titular D, SNI Nivel II

RELIGIOSITY AND WAGE EARNINGS IN POST-SOVIET RUSSIA

ABSTRACT. This article empirically studies the relationship between religiosity, to be a believer or not and to what extent, and wage earnings in post-Soviet Russia. Mincer equations are estimated adding religious affiliation and religiosity as explanatory variables and using dynamic specifications, controlling for endogeneity and time-invariant independent variables. The empirical strategy includes working age individuals (eighteen to sixty) and uses longitudinal data (2000-2017). The results suggest that male believers suffer a wage penalty, about 7%. Moreover, on average, Muslims obtain lower earnings than do individuals from other religious affiliations, roughly 21% less income; for female Muslims this figure is even higher, about 38%. Nonetheless, analysing younger individuals (eighteen to forty-two), the findings are slightly different. In this case, female believers suffer a wage penalty, about 5%. The findings are robust under different specifications, controlling for education, work experience, civil status, migration background, ethnicity, city size, occupation, and macroeconomic conditions.

Tovar-García E. D. (2020). Religiosity and wage earnings in post-Soviet Russia. *Journal of Religion in Europe*, 13(1-2), 45-66. doi: 10.1163/18748929-13010002. Article.

Edgar Demetrio Tovar García

Investigador Titular D, SNI Nivel II

THE BALANCE OF PAYMENTS AND RUSSIAN ECONOMIC GROWTH

ABSTRACT. Based on a demand-side approach, Thirlwall's law claims that, in the long-run, economic growth is constrained by the balance of payments. Income elasticity of demand for exports should be greater than income elasticity of demand for imports in order to grow faster than the limit imposed by export demand. Accordingly, accurate estimations of income elasticities are necessary to identify these bounds. This research estimates export and import functions using bilateral trade data between Russia and 53 of its major partners. Then, we empirically test the validity of Thirlwall's law over the years 1996-2016, generalizing Thirlwall's model in a bilateral panel framework. In addition, export and import functions are estimated taking into account export and import composition, controlling for key sectoral effects on aggregate elasticities. Using dynamic panel data models, the findings suggest that, on average, the Russian economy has been growing faster than what Thirlwall's law predicts. The sectoral composition of the Russian external sector has eased the external constraint to growth. Russian exports still significantly consist of oil and gas, price inelastic goods, with positive effects on trade balance over the period of study. However, in a transition toward green energies, the allocation and investment of exports revenues is a key factor to address future scenarios where carbon-based resources lose relevance.

Tovar-García, E. D. & Carrasco, C. A. (2019). The balance of payments and Russian economic growth. *HSE Economic Journal*, 23(4), 524-541. doi: 10.17323/1813-8691-2019-23-4-524-541. Article.

Edgar Demetrio Tovar García

Investigador Titular D, SNI Nivel II

TRACKING THE CHARACTERISTICS OF ECONOMIC GROWTH VULNERABILITY TO COVID-19: A PRELIMINARY ANALYSIS

[RASTREANDO LAS CARACTERÍSTICAS DE LA VULNERABILIDAD DEL CRECIMIENTO ECONÓMICO AL COVID-19: UN ANÁLISIS PRELIMINAR]

ABSTRACT. In response to the global expansion of COVID-19, governments around the world have implemented social distancing measures resulting in an unprecedented fall in economic activity. Consequently, the economic growth forecasts for 2020 have been adjusted downward in most countries, yet the magnitude of the decline has been different. In this article, we examine the economic vulnerability to COVID-19-measured as the change in GDP growth forecasts for 2020-and its determinants for a sample of 194 countries. We identify the characteristics of the external sector and macroeconomic policy stance that are associated with an increase in economic vulnerability during the pandemic.

Carrasco C. A. & Tovar-García E. D. (2020). Tracking the characteristics of economic growth vulnerability to COVID-19: A preliminary analysis [Rastreado las características de la vulnerabilidad del crecimiento económico al COVID-19: Un análisis preliminar]. *Revista de Economía Mundial*, 56, 1-24. doi: 10.33776/rem.voi56.4832. Article.



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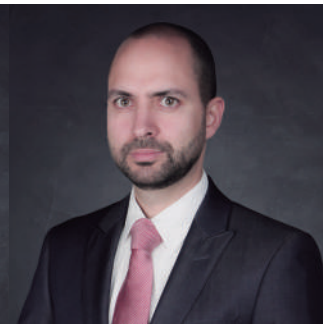
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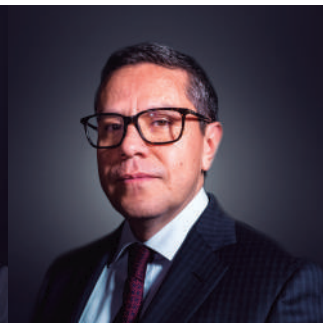
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¹⁷ Colaboración en un artículo publicado en Facultad de Ingeniería (p. 138).

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THE PARAMETER OF CONSTITUTIONAL REGULARITY AND THE SUPREME LAW OF THE LAND

[EL PARÁMETRO DE REGULARIDAD CONSTITUCIONAL Y LA LEY SUPREMA DE LA UNIÓN]

ABSTRACT. The purpose of this paper is to study the re signification process of the supreme law of the Union contained in article 133 of the Constitution, based on the identification and development of the constitutional regularity parameter by the Supreme Court of Justice of the Nation. In order to do so, we will first proceed to study the concept of the supreme law of the Union giving special attention to the observable variations in its content in relation to the location of the international source right. Then, we will analyze the conformation of the parameter of constitutional regularity as a block of rights and the problems for the solution of differences and antinomies in its interior. In the third section we will proceed to determine the transformations generated in the content of the supreme law of the union from the incorporation of the parameter of constitutional regularity.

Acuña, J. M. (2020). The parameter of constitutional regularity and the supreme law of the land [El parámetro de regularidad constitucional y la ley suprema de la Unión]. *Cuestiones Constitucionales*, 2020(42), 73-101. doi: 10.22201/ijj.24484881e.2020.42.14337. Review.

Jorge Manuel Aguirre Hernández

SNI Nivel I

THE NEED TO THINK ABOUT POVERTY IN THE LEGAL SENSE

ABSTRACT. Poverty, despite being an obvious violation of human rights, does not seem to be a matter of concern for those in the legal field. Considerations to be made with respect to the right to human dignity and the minimum wage make this matter one that is evidently part of the legal contents and, therefore, turn it into an issue upon which reflection -in legal terms- is required.

Aguirre Hernández, J. M. (2019). The Need to Think about Poverty in the Legal Sense. *Journal of Poverty*, 24(2), 95-112. doi: 10.1080/10875549.2019.1656140. Article.

Clara Luz Álvarez González de Castilla

SNI Nivel III

RETHINKING MUST-CARRY AND RETRANSMISSION CONSENT REGULATION IN THE DIGITAL ERA

ABSTRACT. Purpose - The emergence of new technological platforms to access online services and content have transformed the media landscape dramatically. Such transformation requires policymakers to reexamine the decades-old regulations traditionally addressed to broadcasters and telecommunications providers as must-carry and retransmission consent rules. This paper reviews must-carry regulation and case law in the United States of America, Mexico, and France. That is because each one of these countries has offered a variety of justifications for such rules (competition, local content, viewers' rights, diversity). The purpose of this review is to analyze whether or not the original reasons for must-carry regulation are still valid in the digital era. Methodology/ approach/design - The research was conducted through document review and analysis of norms and case law from each one of the selected countries (USA, Mexico, and France) based on information collected via academic research. Also, analysis of statistical sources of information was attained to portray the penetration status of telecommunication services over the last decades in order to fully understand the context in which must-carry rules were enacted. Findings - Policymakers should consider other regulatory mechanisms to achieve the original reasons for must-carry rules. The dramatic increase in the variety of devices (e.g., TV, tablet, mobile phones, smart TVs), service and content distributors (e.g., free-to-air TV, cable TV, internet), and service providers (e.g., broadcasters and over-the-top internet providers) strongly suggests a reconsideration of the current approach. Yet any amendment to the current regulation will depend on internet penetration and access to new video distribution platforms in a given geographic area. That is to say, without internet access, free-to-air TV might continue to be an important platform for service and content distribution. Practical implications - Identifying and analyzing the reasons for imposing must-carry rules in connection with the telecommunication services penetration over the past decades, provides the necessary framework to assess the convenience and need to maintain such rules or to introduce changes and identify which modifications must be done to further the objectives pursued in a given country. Originality/value - This research is original insofar as it analyses must-carry rules and case law of three different countries with their own background and objectives. Must-

carry rules are being enacted in several countries including in those in Latin America. This paper is useful for both policymakers and researchers to provoke an in-depth analysis as to whether must-carry rules should be enacted, amended or eliminated, based on the specific context and objectives pursued in a given country.

Álvarez, C. L. (2020). Rethinking must-carry and retransmission consent regulation in the digital era. *Revista de Direito, Estado e Telecomunicacoes*, 12(1), 9-57. doi: 10.26512/lstr.v12i1.24914. Article.

José Antonio Lozano Díez

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Román Rodríguez Aguilar

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DYNAMICS OF PRICES AND CONSUMPTION OF UNHEALTHY FOODS AS A MONITORING TOOL OF THE STRATEGY AGAINST OBESITY IN MEXICO

ABSTRACT. INTRODUCTION: Mexico faces an epidemic of overweight and obesity, in 2018 75% of adults were overweight or obese. This condition as a risk factor generates a significant financial impact in the Health Sector. In response, the National Strategy for Prevention and Control of Overweight, Obesity, and Diabetes was implemented in 2013, which included as one of its pillars the implementation of fiscal policies. As part of fiscal policy, taxes were established on sugary drinks and foods with high-calorie content. Seven years after the implementation of the Strategy to control the epidemic of overweight and obesity, there have been some results. However, it is necessary to continue working and especially monitoring the performance of the different actions implemented. OBJECTIVES: Propose an analytical intelligence model for monitoring the fiscal policies implemented to control overweight and obesity in Mexico. METHODS: The proposed analytical intelligence model considers three methodological bases, a) price index of healthy and unhealthy foods through Principal Component Analysis, b) volatility measurement of both baskets through a GARCH model and c) monitoring of consumption patterns through household income and expenditure surveys. RESULTS: The main results identified a price differential between the baskets of products healthy and unhealthy, especially at the beginning of the fiscal policy. Healthy products have higher price volatility than unhealthy products and according to consumption patterns, on average Mexican households spend 30% of their

food expenditure on unhealthy products. CONCLUSION: To strengthen fiscal actions to control overweight and obesity, it is recommended to have monitoring systems for the dynamic design and implementation of public policies. Although taxes have reduced in some grade the consumption of unhealthy products, it is necessary to promote the affordability of healthy products, helping to improve the diet of Mexican households.

Lozano-Díez, J. A. & Rodríguez-Aguilar, R. (2020). Dynamics of prices and consumption of unhealthy foods as a monitoring tool of the strategy against obesity in Mexico. *EAI Endorsed Transactions on Pervasive Health and Technology*, 5(20). doi: 10.4108/ea1.5-5-2020.164218. Article.

Jorge Eduardo Medina Villanueva

SNI Nivel C

PUNITIVE DAMAGES IN MEXICAN LAW. SOME IDEAS FOR ITS INTERPRETATION

[LOS DAÑOS PUNITIVOS EN EL DERECHO MEXICANO. ALGUNAS IDEAS PARA SU INTERPRETACIÓN]

ABSTRACT. Recently, the First Chamber of the Supreme Court of Justice of the Nation issued a resolution in which it declared the admissibility of punitive damages in Mexican law, in matters of moral damage. However, applying a detailed analysis of the sentence, its arguments and grounds, leads us to the conclusion that this figure has very little in common with the "punitive damages" applied in the common law legal systems, and refers only to how to quantify the compensation awarded to the victim.

Medina Villanueva J. E. (2020). Punitive damages in Mexican law. Some ideas for its interpretation [Los daños punitivos en el derecho mexicano. Algunas ideas para su interpretación]. *Boletín Mexicano de Derecho Comparado*, 52(157), 221-242. doi: 10.22201/ij.24484873e.2020.157.15230. Article.

José Edgardo Muñoz López

SNI Nivel I

SOFTWARE TECHNOLOGY IN CISG CONTRACTS

ABSTRACT. Software technology has changed the way businesses operate and the items traded globally. These advances demand a fast and adequate evolution of the law. This paper supports the view that the CISG is equipped with the rules needed to address recent changes in software

technology; it demonstrates how the general legal principles, upon which the CISG is based, may serve to achieve a proper interpretation and supplementation of this uniform sales law. The author submits, for instance, that a dynamic notion of goods, which includes software, can be revealed by considering the parties' main obligations under the Convention. In addition, he advocates for a modern understanding of CISG terms in order to apply the rules on contract formation to new realities. Finally, he highlights some performance issues that may arise in the sale of software, including specific methods of examination, and of giving notice of any lack of conformity.

Muñoz, J. E. (2019). Software technology in CISG contracts. *Uniform Law Review*, 24(2), 281-301. doi: 10.1093/ulr/unzo16. Article.

Pedro de Jesús Pallares Yabur

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RETHINKING THE UNIVERSALITY AND NEUTRALITY OF PENG CHUN CHANG IN THE DRAFTING OF THE UNIVERSAL DECLARATION OF HUMAN RIGHTS IN CONVERSATION WITH THE CONTRIBUTIONS OF CHARLES MALIK

[REPENSAR LA UNIVERSALIDAD Y NEUTRALIDAD DE PENG CHUN CHANG EN LA REDACCIÓN DE LA DECLARACIÓN UNIVERSAL DE DERECHOS HUMANOS PUESTA A DEBATE POR LAS APORTACIONES DE CHARLES MALIK]

ABSTRACT. This article explains the ideas behind the conclusion that the contributions of chinese delegate, Peng Chun Chang, were essential to the universal and intercultural nature of the Universal Declaration of Human Rights. At the same time, these premises are explained in more detail to show that they do not necessarily make the Declaration a construable text in the light of Rawls's overlapping consensus. In addition, an explanation is offered for the sense in which the writers of the Declaration incorporated an argument of philosophical foundation, and for the role that lebanese delegate, Charles Malik, had in that process.

Pallares-Yabur, P. (2019). Rethinking the universality and neutrality of peng chun chang in the drafting of the universal declaration of human rights in conversation with the contributions of charles malik [Repensar la universalidad y neutralidad de peng chun chang en la redacción de la declaración universal de derechos humanos puesta a debate por las aportaciones de charles malik]. *Boletín Mexicano de Derecho Comparado*, 51(155), 969-995. doi: 10.22201/ijj.24484873e.2019.155.14953. Article.

José María Soberanes Díez

Investigador Titular B, SNI Nivel II

LA SUSPENSIÓN DE LAS NORMAS GENERALES EN LAS ACCIONES DE INCONSTITUCIONALIDAD

ABSTRACT. El objeto de este trabajo es analizar las resoluciones jurisdiccionales en la que se desarrolló la procedencia de la acción: el auto del ministro instructor, y las tres sentencias de los recursos de reclamación interpuestos que lo confirmaron. Para ello se expondrán los antecedentes del asunto (apartado II); se tratarán algunos aspectos procesales propios de este caso (apartado III); y finalmente, se abordará la creación de la suspensión en las acciones de inconstitucionalidad (apartado IV). ©2020 Universidad Nacional Autónoma de México, Instituto de Investigaciones Jurídicas.

Soberanes Díez, J. M. (2020). La suspensión de las normas generales en las acciones de inconstitucionalidad. *Cuestiones Constitucionales*, 2020(42), 409-424. doi: 10.22201/ijj.24484881e.2020.42.14348. Review.

Carlos Alberto Soriano Cienfuegos

SNI Nivel I

RETHINKING THE PUBLIC RIGHT TO INFORMATION IN MEXICAN DEMOCRATIC SOCIETY

[REPENSAR EL DERECHO PÚBLICO A LA INFORMACIÓN EN LA SOCIEDAD DEMOCRÁTICA MEXICANA]

ABSTRACT. This article proposes that the conceptual distinction of the different aspects of the right to information is fundamental for the adequate conformation of the positive law that regulates it. The foregoing is applicable to the entire corpus iuris, from the constitutional texts to the more detailed regulations that exist in this regard. The need for conceptual clarity has, as a consequence, additionally, a more precise normative conception of the informative guarantees necessary for the proper exercise of the right and a guaranteeing vision on the way to establish its directives.

Soriano Cienfuegos, C. (2020). Rethinking the public right to information in Mexican democratic society [Repensar el derecho público a la información en la sociedad democrática mexicana]. *Cuestiones Constitucionales*, 2020(42): 357-389. doi: 10.22201/ijj.24484881e.2020.42.14346. Article.

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ON THE GREED AND LUXURY OF ENCOMENDEROS IN BARTOLOMÉ DE LAS CASAS'S EIGHTH REMEDY

[SOBRE AVARICIA Y LUJO DE ENCOMENDEROS EN EL OCTAVO REMEDIO DE BARTOLOMÉ DE LAS CASAS]

ABSTRACT. This text analyzes the reasons given by Bartolomé de las Casas in the treatise Eight Remedy with the aim of proving that the Dominican's argumentative focus consists of encomenderos' greed and luxuries. For Las Casas, neither natural law nor law of nations provide a legitimate justification for depriving natives of their properties or for raising taxes for them beyond what the laws of Castile and the Spanish Crown had already stipulated. However, these arguments, in compliance with the economic criteria of Salamanca authors, are exceeded and radicalized by Las Casas in so far as he focuses on encomenderos' greed and luxury. The Eighth Remedy quotes biblical writings and Aristotelian texts on ethics in order to emphasize that natives' freedom implies inalienable rights of property and possession. Because of this, the Eighth Remedy puts into question the very encomiendas that were taking place in New Spain. Las Casas comes from a Salamanca school of thought, but he radicalizes his discourse by employing passages of the Old Testament in the face of the problem of exclusion, thus establishing an emancipating and liberating economic discourse in America which focuses on the opulence and greed of the ruling class.

Aspe V. (2020). On the greed and luxury of encomenderos in bartolomé de las casas's eighth remedy [Sobre avaricia y lujo de encomenderos en el octavo remedio de bartolomé de las casas]. *Cauriensa*, 15, 87-108. doi: 10.17398/2340-4256.15.87. Article.

Virginia Aspe Armella

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Mauricio Lecón Rosales

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PRESENTATION: ECONOMIC THOUGHT OF THE SCHOOL OF SALAMANCA. BACKGROUND AND RECEPTION

[PRESENTACIÓN: PENSAMIENTO ECONÓMICO DE LA ESCUELA DE SALAMANCA. ANTECEDENTES Y RECEPCIÓN]

ABSTRACT. El presente volumen de la revista Cauriensa está dedicado al pensamiento económico

de la Escuela de Salamanca. En él reunimos once investigaciones, a cargo de catorce autores en total –diez hombres y cuatro mujeres– de distintas nacionalidades y pertenecientes a diversas universidades públicas y privadas. Desde principios del siglo pasado, los estudios especializados sobre el pensamiento económico de los autores salmantinos han aumentado exponencialmente. Hasta el punto en que, actualmente, no sólo gozamos de un vasto acervo bibliográfico sobre la materia, sino de trabajos altamente sofisticados que han contribuido a la recuperación, evaluación y análisis críticos de sus principales ideas. Aunque el estado de la cuestión es favorable, dista mucho de ser definitivo o, siquiera, comparable con los avances alcanzados en otras áreas de la filosofía y la economía.

Estamos convencidos de que, en lo individual y en lo colectivo, este monográfico es una valiosa aportación a esa tarea pendiente; entre otras razones, porque tiene tres grandes cualidades. En primer lugar, el volumen atiende a las influencias, el desarrollo y la recepción de algunas ideas o problemas discutidos por los autores de la Escuela. La visión panorámica y ordenada que colectivamente construyen estos trabajos no sólo permite situar a los autores salmantinos en la tradición filosófica y económica, sino que también captura el dinamismo contextual de la Escuela; es decir, revisa los antecedentes y recepción de las ideas económicas posibilitando así lecturas o interpretaciones más robustas sobre sus integrantes. En segundo lugar, el volumen se compone de once aproximaciones originales a problemas típicos sobre las ideas económicas salmantinas. Dicha originalidad resulta de las diferentes áreas de especialización desde las cuales proceden los autores: algunos expertos en filosofía antigua, otros en filosofía medieval, renacentista o, incluso moderna. Esta diversidad dota al número de una frescura que se ve reflejada en los temas, ángulos y métodos para abordar problemas típicos en estos autores. Por último, destacamos que el volumen supera algunos vicios en los que ha incurrido la literatura especializada; a saber, el tono apologético y la regionalización de los estudios. Ante la prolongada omisión y desconocimiento de la Escuela de Salamanca en la historia la filosofía y de la economía, los primeros estudiosos emprendieron la reconstrucción de ideas y decididamente adoptaron un tono Reivindicatorio con los distintos autores. Con el paso del tiempo, estos esfuerzos maduraron dando lugar a trabajos que abandonaron el abordaje expositivo de decir quién es el autor, describir su producción, contexto y las generalidades de su pensamiento para, en cambio, realizar análisis moderados y sofisticados con herramientas filológicas, históricas y documentales. En sintonía con esta evolución, varios trabajos del presente número asumen una posición crítica hacia los autores salmantinos y hacia sus ideas; lo cual ayuda a ponderar mejor sus aportaciones y reparar en sus limitaciones o defectos. Adicionalmente,

la alta participación de académicos latinoamericanos confirma a la Escuela de Salamanca como un objeto de interés general para la academia y no sólo para hispanistas o libertarios –quienes rehabilitaron el pensamiento económico salmantino por su aparente simpatía con la Escuela Austríaca–. Puede decirse, entonces, que estamos ante planteamientos más aporéticos cuyo valor está en las preguntas que despiertan y en la interpretación contextual que hacen de las fuentes salmantinas. Así las cosas, el volumen goza de una unidad orgánica en la que una diversidad de enfoques e inquietudes convergen en una narrativa histórica y temática [...].

Aspe V. & Lecón M. (2020). Presentation: Economic thought of the school of salamanca. background and reception [Presentación: Pensamiento económico de la escuela de salamanca. antecedentes y recepción]. *Cau-riensia. Revista Anual de Ciencias Eclesiásticas*, 15, 15-22. doi: 10.17398/2340-4256.15.15. Article.

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SNI Nivel III

THE POLITICAL DILEMMAS OF THE TRANSFORMATIONS OF MEXICO: A PHILOSOPHICAL APPROACH

[LOS DILEMAS POLÍTICOS DE LAS TRANSFORMACIONES DE MÉXICO: UNA APROXIMACIÓN FILOSÓFICA]

ABSTRACT. The aim of this paper is to analyze the philosophical arguments that underpin the four political transformations of Mexico. This analysis provides a detailed account of the difficulties Mexico has had for consolidating the principles of freedom and equality. In what follows, I track the origin of the Mexican left in the 19th century from authors, such as Ignacio Ramírez, to concerns that appear within two contrasting moral Cartillas, the first one written by Alfonso Reyes, and the second one, that of Fourier, brought to Mexico by Plotinus Rhodakanaty. Subsequently, I propose a possible link between anarchism and the political and moral philosophy that underpins the ideology of Andrés Manuel López Obrador. I shall highlight the tensions within the ideology of the fourth transformation, especially those existing between government centralization and the weakening of some institutions, the latter, a premise inherited from the anarchist ideology.

Armella, V. A. (2020). The political dilemmas of the transformations of Mexico: A philosophical approach [Los dilemas políticos de las transformaciones de México: una aproximación filosófica]. *Tópicos (México)*, 58, 375-410. doi: 10.21555/top.voi58.1157. Article.

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JAVIER ESPINO MARTÍN, GIUDITTA CAVALLETTI (EDS.) (2017). RECEPTION AND MODERNITY IN THE 18TH CENTURY. CLASSICAL ANTIQUITY IN THE CONFIGURATION OF ENLIGHTENED THOUGHT. MEXICO: CENTER FOR CLASSICAL STUDIES, INSTITUTE OF PHILOLOGICAL RESEARCH, UNAM

[JAVIER ESPINO MARTÍN, GIUDITTA CAVALLETTI (EDS.) (2017). RECEPCIÓN Y MODERNIDAD EN EL SIGLO XVIII. LA ANTIGÜEDAD CLÁSICA EN LA CONFIGURACIÓN DEL PENSAMIENTO ILUSTRADO. MÉXICO: CENTRO DE ESTUDIOS CLÁSICOS, INSTITUTO DE INVESTIGACIONES FILOLÓGICAS, UNAM]

ABSTRACT. Es bien sabido que hay distintas formas de abordar a los clásicos. La forma más decimonónica es la de revisar escrupulosamente su lenguaje y sus textos y estudiarlos de una manera que, en términos generales, bien puede llamarse inmanente. Dentro de la misma tesitura, una aproximación preponderantemente inmanente –aunque con tintes sistemáticos– puede ser también aquella que no sólo busca documentar la coherencia o evolución de una obra, sino que, al menos en el caso de los filósofos, pretende dirimir si los argumentos y las teorías propuestas por un pensador son verdaderas, si son conceptualmente sólidas, si pueden ser hoy todavía sostenidas, etcétera. En alguna medida u otra, no obstante, estos estudios que he denominado inmanentes están generalmente mejor logrados cuando no ignoran o no están completamente cerrados a lo externo, es decir, cuando no desvinculan a las obras del contexto de su producción, del ambiente histórico, artístico, sociopolítico, religioso, etcétera que las vio nacer, y, para el caso que nos ocupa, que no soslayan la manera en que han sido interpretadas o recibidas a lo largo del tiempo. En suma, para decirlo con Gadamer, cuando no ignoramos su Wirkungsgeschichte, esto es, la historia de sus efectos.

Esta clase de estudios que se abren a la recepción, durante mucho tiempo, al menos en el contexto hispanohablante filológico, ha sido visto con cierto menosprecio. Como si, por decirlo de alguna forma, fuesen estudios de segundo orden o rango, mismos que tendrían que estar supeditados a las primeras aproximaciones antes aludidas –donde reposaría el valor genuino de los estudios clásicos– y que sólo tendrían, en el mejor de los casos, un valor de corolario o de añadido. Por fortuna, han aparecido estudios de recepción de calidad en los últimos años que poco a poco han ido corrigiendo esa falsa apreciación. Y a mi entender, el libro editado por Espino Martín y por Cavalletti es claramente una contribución que abona de forma positiva en dicha dirección. Los autores convocados en el libro –sin seguir ninguno

de ellos alguna línea dogmática– tienen como denominador común el sostener un diálogo dinámico con los clásicos; en otras palabras, no los ven como piezas o reliquias de museo, sino como interlocutores vivos que fueron vistos como tales por pensadores de una época que, falsamente, se ha creído fue abierta y claramente hostil ante todo el pensamiento clásico: la Ilustración.

Elorduy, E. C. (2019). Javier Espino Martín, Giuditta Cavalletti (eds.) (2017). *Recepción y modernidad en el siglo XVIII. La antigüedad clásica en la configuración del pensamiento ilustrado*. México: Centro de Estudios Clásicos, Instituto de Investigaciones Filológicas, UNAM. *Tópicos (México)*, 58, 421-425. doi: 10.21555/TOP.Vol58.1137. Review.

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ORIGIN AND DEVELOPMENT OF KANT'S CONCEPTION OF THE LAW OF PEOPLES. REFLECTIONS ON THE FEYERABEND LECTURE ON NATURAL RIGHT AND THE ELEMENTA IURIS NATURAE OF GOTTFRIED ACHENWALL

[ORIGEN Y DESARROLLO DE LA CONCEPCIÓN DEL DERECHO DE GENTES EN KANT. REFLEXIONES EN TORNO A LA VORLESUNG NATURRECHT FEYERABEND Y A LOS ELEMENTA IURIS NATURAE DE GOTTFRIED ACHENWALL]

ABSTRACT. My aim in this paper is to examine the genesis and development of the notion of law of peoples (*ius gentium*) in Kant's thought. For that purpose, I reconstruct first the main tenets of Gottfried Achenwall's thought in his work *Elementa Iuris Naturae*. In a next step, I analyze Kant's 1784 Feyerabend Lecture on Natural Right in which he exposes but also engages in a very critical way –without having yet his own full-blown legal theory– with many of Achenwall's theses regarding the law of peoples and, in particular, with what Achenwall has to say regarding the *ius belli*. Finally, in the last part of this paper, I aim to show that many of Kant's ideas in his mature works on legal and political philosophy of the 1790s can be traced back to the lecture he delivered based on Achenwall's treatise on natural law, and are much better understood under that light. In the end, I establish that both the continuities and ruptures between Achenwall and Kant disclose a profound bond between the two authors, which is susceptible of being further studied.

Charpenel, E. (2020). Origin and development of Kant's conception of the law of peoples. Reflections on the feyerabend lecture on natural right and the elementa iuris naturae of gottfried achenwall [Origen y desarrollo de la concepción del derecho de gentes en Kant. Reflexiones en torno a la Vorlesung Naturrecht Feyerabend y a los Elementa Iuris Naturae de Gottfried Achenwall]. *Con-textos Kantianos*, 11, 383-405. doi: 10.5281/zenodo.3862890. Article.

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THE SUMMUM BONUM IN KANT'S RELIGIONSSCHRIFT

[EL SUMMUM BONUM EN EL RELIGIONSSCHRIFT DE KANT]

ABSTRACT. In this article, my aim is to show that the theory of the highest good in the *Religion within the Bounds of Bare Reason* reflects great coherence and unity with what Kant says on the same topic in other works. In contrast with commentators who endorse a secular humanist reading of this notion in Kant's late works, I defend the thesis that the highest good must be interpreted –due to textual and systematic reasons– as a notion which, on the one hand, is irreducible to mere political or moral enterprises, and, on the other, presupposes God as a transcendent being who gives his aid to human beings in order for them to overcome moral and physical evils and attain happiness in proportion to virtue.

Charpenel, E. (2020). The summum bonum in Kant's Religionsschrift [el summum bonum en el Religionsschrift de Kant]. *Signos Filosóficos*, 22(43), 58-87. Article.

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VIRTUE OR DUTY? HEGELIAN CONSIDERATIONS ON AN APPARENT DISJUNCTION

[¿VIRTUD O DEBER? ALGUNAS CONSIDERACIONES HEGELIANAS SOBRE UNA APARENTE DISYUNCIÓN]

ABSTRACT. This article explores Hegel's discussion and appropriation of Aristotle and Kant within his *Outlines of the Philosophy of Right*. In the interpretation I want to put forward, I claim that Hegel has relevant and systematic reasons to argue for a point of view in which neither virtue nor duty have, as ethical categories, the upper hand in practical philosophy. By doing this, I intend to show that Hegel provides us with important elements to think that virtue and deontological ethics do not have to be necessarily conceived as if they were antagonistically opposed to each other.

Charpenel, E. (2019). Virtue or duty? Hegelian considerations on an apparent disjunction [¿virtud o deber? Algunas consideraciones hegelianas sobre una aparente disyunción]. *Open Insight*, 10(20), 53-78. doi: 10.23924/oi.v10n20a2019.pp%25p.373. Review.

André Laks

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THE LEVER, OR HOW TO ACT AT A DISTANCE: A BACKDROP TO THEOPHRASTUS' DE SENSIBUS

ABSTRACT. It is well known that when it comes to perception in the *De anima*, Aristotle uses affection-related vocabulary with extreme caution. This has given rise to a debate between interpreters who hold that in Aristotle's account, the act of sense-perception nevertheless involves the physiological alteration of the sense organ (Richard Sorabji), and those think, with Myles Burnyeat, that for Aristotle, perception does not involve any material process, so that an Aristotelian physics of sense-perception is a "physics of forms alone". The present article suggests that the dematerialisation of Aristotle's theory of perception, which has a long story from Alexander of Aphrodisias to Brentano, may be in fact traced back to Theophrastus' exegesis of Aristotle's relevant passages in the *De anima* in his *Physics*, as we can reconstruct it on the basis of Priscian's *Metaphrasis* in *Theophrastum* and Simplicius' commentary of Aristotle's *De Anima*. The reconstruction also provides a scholastic-theoretical frame to Theophrastus' critical exposition of ancient theories about sense perception in his *De sensibus*, whether or not the discussion originally belonged to Theophrastus' *Physics*.

Laks, A. (2020). The Lever, or How to Act at a Distance: A Backdrop to Theophrastus' *De sensibus*. *Rhizomata*, 7(2), 168-187. doi: 10.1515/rhiz-2019-0008. Review.

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THE SCHOOL OF SALAMANCA'S CRITICISMS TO THE THEORY OF JUST PRICE OF DUNS SCOTUS REVISITED

[ANÁLISIS DE LAS CRÍTICAS SALMANTINAS A LA TEORÍA DEL PRECIO JUSTO DE DUNS ESCOTO]

ABSTRACT. Duns Scotus's economic ideas were strongly objected to during the XVth and XVIth centuries. Some of the most notable thinkers of the time, such as Domingo de Soto (1494-1560), Luis de Molina (1535-1600) and John de Lugo (1583-1660), considered that the scotist notion of price was wrong for including in it the production costs and the merchant's utility. The School of Salamanca's emphasis on the fact that common estimation is the main source of justice on the price has received the appreciation of authors like Raymond de Roover (1904-1972), Marjorie Grice-Hutchinson (1908-2003) and Murray N. Rothbard

(1926-1995), who recovered the criticism against Duns Scotus. The aim of this work is to show that such critiques do not proceed, since they excessively simplify or decontextualize Scotus' thesis. For that purpose 1) I will briefly present the most important remarks of the salmantine authors regarding the subjective theory of value; 2) I will analyze the scotist texts that contain his account on it; 3) I will then argue that the salmantine and contemporary criticisms are imprecise, and instead 4) I will suggest an affinity between Scotus's and the School of Salamanca's economic ideas.

Lecon M. (2020). The school of salamanca's criticisms to the theory of just price of duns scotus revisited [Análisis de las críticas salmantinas a la teoría del precio justo de duns escoto]. *Cauriensa*, 15, 43-61. doi: 10.17398/2340-4256.15.43. Article.

Luis Xavier López Farjeat

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Cecilia María Coronado Angulo

SNI Nivel C

GROUP ASYLUM, SOVEREIGNTY, AND THE ETHICS OF CARE

ABSTRACT. It is assumed that the states have the right to control their borders and decide whom they want to exclude, isolate, ban, or impose restrictions on. Although it seems that the problematic notion of "sovereignty" gives the state the right to make these kinds of decisions, there are situations where ethical duties to other human beings supersede sovereignty and where, in fact, those ethical duties limit sovereignty. This would be the case of group asylum situations. In this paper, we propose Axel Honneth's ethics of recognition as a complement to the liberal notion of solidarity. By introducing a derivation of the ethics of recognition, namely, the "ethics of care," we argue that our connection to others and the ethical duties we have with them impose some limits on the idea of sovereignty.

López-Farjeat, L.X. & Coronado-Angulo, C. (2020). Group asylum, sovereignty, and the ethics of care. *Social Sciences*, 9(8), 1-11. doi: 10.3390/socsci9080142. Article.

Luis Xavier López Farjeat

Investigador Titular D, SNI Nivel III

RELIGIOUS PLURALITY AND NONVIOLENCE IN SAID NURSI AND FETHULLAH GÜLEN

ABSTRACT. In this paper I introduce two ways of conceptualizing Islam from the way in which two thinkers from the modern and contemporary Turkey, respectively, assume ethical and social values usually identified with the democratic culture: religious

plurality, tolerance and nonviolence. Said Nursi and Fethullah Gülen conceive, in the face of the stereotype of an intolerant and violent Islam, a non-violent Islam, capable of recognizing other creeds and coexist with them. Despite the sociopolitical and religious tensions that both views have caused especially in Turkey, both could be understood as enemies of Islamic fundamentalism. From their respective positions, both thinkers face the epistemological problem discussed in this paper, that is, the tension between exclusivism and religious pluralism or religious diversity. Is it possible to harmonize distinct religions that assume themselves as true? By means of the historical-philosophical analysis of Nursi and Güllen an answer to this question will be offered.

López-Farjeat L. X. (2019). Religious Plurality and Nonviolence in Said Nursi and Fethullah Gülen. *Andamios*, 16(40), 131-149. doi: 10.29092/uacm.v16i40.700. Article.

Leonardo Ruiz Gómez

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SALUTIS ENIM PUBLICAE MAXIMA SEMPER RATIO HABENDA EST: LEIBNIZ AND THE SCHOOL OF SALAMANCA ON THE MORALITY OF INSURANCES

[SALUTIS ENIM PUBLICAE MAXIMA SEMPER RATIO HABENDA EST: LEIBNIZ Y LA TRADICIÓN SALTANTINA SOBRE LA MORALIDAD DE LOS SEGUROS]

ABSTRACT. Leibniz proposed a natural disaster insurance coordinated by the government. This proposal was aligned with a tradition of political, economic and ethical thought that is grounded in scholastic philosophy and, particularly, in the School of Salamanca. This paper aims to offer a general view of the discussion in late-medieval philosophy regarding insurance; the analysis will point out two troublesome issues: The problem of usury and the problem of divine providence. From this, I will explain some particularities of the Leibnizian proposal on the scope of the late medieval debate by showing its originality and relation with the School of Salamanca.

Ruiz-Gomez L. (2020). *Salutis enim publicae maxima semper ratio habenda est: Leibniz and the school of salamanca on the morality of insurances [Salutis enim publicae maxima semper ratio habenda est: Leibniz y la tradición saltantina sobre la moralidad de los seguros]*. *Cauriensia*, 15, 255-278. doi: 10.17398/2340-4256.15.255. Article.

Héctor Jesús Zagal Arreguín

SNI Nivel III

NATURE AND DEMON ON DREAMS AND PROPHESES IN ARISTOTLE

[NATURALEZA Y DEMONIO A PROPÓSITO DE ENSUEÑOS Y ADIVINOS EN ARISTÓTELES]

ABSTRACT. In *On Divination*, Aristotle states that "nature is demonic". The adjective is difficult to translate and it has a supernatural connotation in both Greek and Spanish. But if Aristotle does not explain the natural by appealing to the supernatural, why does he use this adjective? In order to resolve this difficulty, the article proposes a moderate reading of the adjective demonic. "Marvelous" is a good translation, because it suggests that nature is surprising but that this does not mean it lacks a natural explanation.

Zagal Arreguín, H. J. (2020). Nature and demon on dreams and prophecies in Aristotle [Naturaleza y demonio A propósito de ensueños y adivinos en Aristóteles]. *Ideas y Valores*, 69(172), 9-20. doi: 10.15446/ideasyvalores.v69n172.64494. Article.

Héctor Jesús Zagal Arreguín

SNI Nivel III

THE SIN OF USURY IN THE SUMMA THEOLOGIAE OF THOMAS AQUINAS: THE POWER OF MONEY

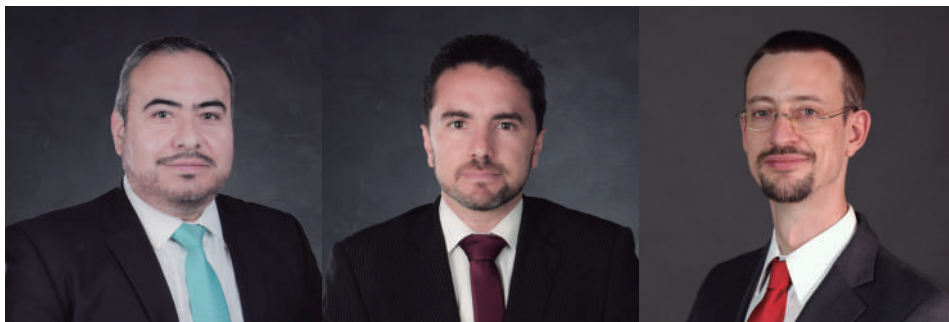
[EL PECADO DE USURA EN LA SUMA TEOLÓGICA DE TOMÁS DE AQUINO: LA POTENCIA DEL DINERO]

ABSTRACT. In *quaestio 78* of the *Summa Theologiae*, Thomas Aquinas criticizes the charge of interest by a monetary loan arguing it to be unfair in itself. Aquinas' condemnation to usury as an unfair action has its foundations on a passage of the *Nicomachean Ethics*, where Aristotle talks of virtue as the right balance between an excess and a defect, differentiating it from actions that are wrong on the whole. Herein, Saint Thomas rescues Aristotle to determine the nature of money as a tool, i.e. its own and main use. Aquinas accepts that each object has its own end and exchange value *per se*. However, he regards money as a changeable object whose actual value cannot increase without a measure of contrast or the work of an agent. By analysing the actual and potential worth of money, we can understand why Saint Thomas insists on usury as an unfair action *per se*.

Zagal Arreguín H. J. (2020). The sin of usury in the *summa theologiae* of thomas aquinas: The power of money [El pecado de usura en la suma teológica de tomás de aquino: La potencia del dinero]. *Cauriensia*, 15, 23-41. doi: 10.17398/2340-4256.15.23. Article.



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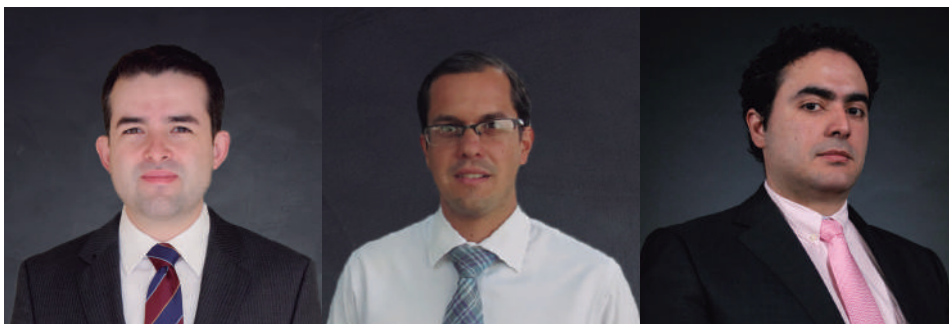
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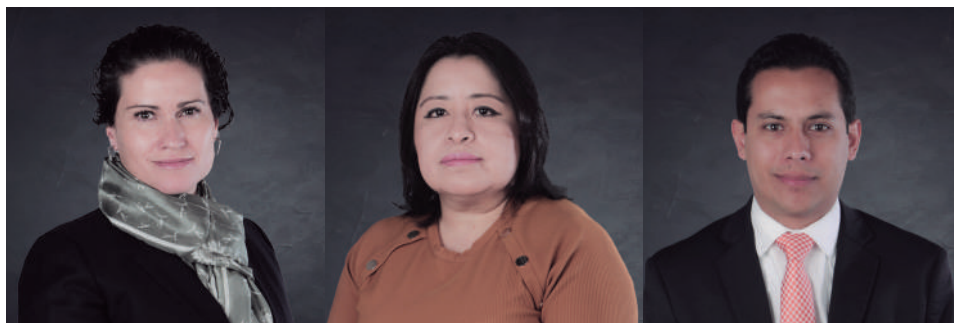
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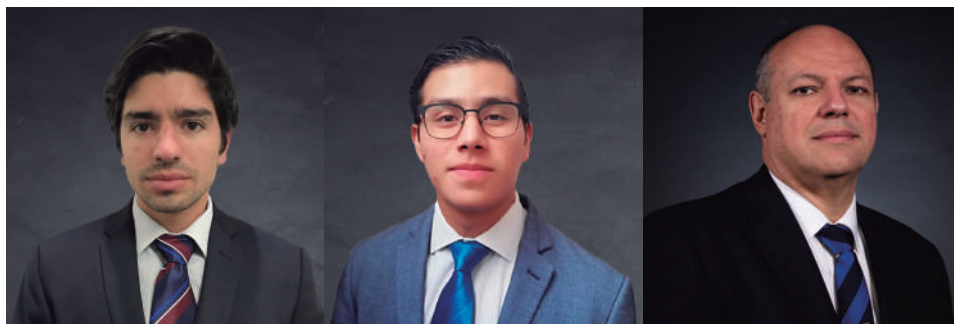
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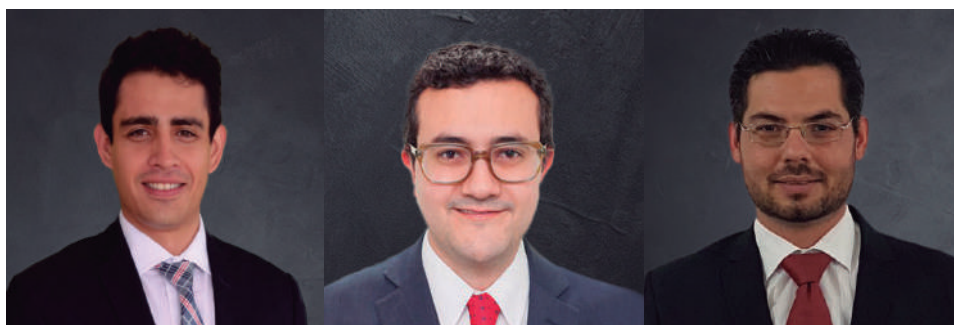
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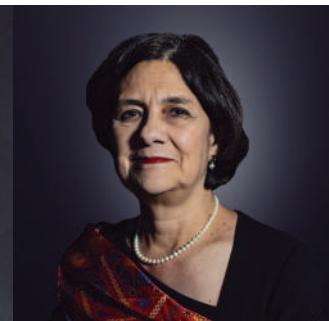
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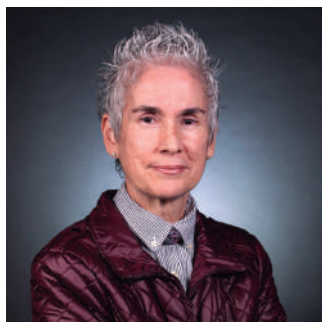
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¹⁹ Colaboración en un artículo publicado en Facultad de Ciencias de la Salud (p. 59).

²⁰ Colaboración en un artículo publicado en Facultad de Ciencias de la Salud (p. 59).

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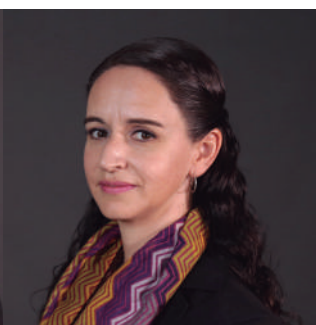
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²⁴ Colaboración en un artículo publicado en Facultad de Ciencias Económicas y Empresariales (p. 81).



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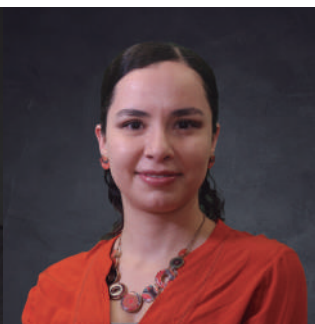
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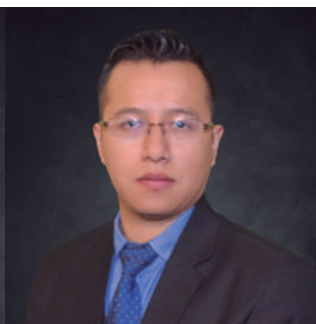
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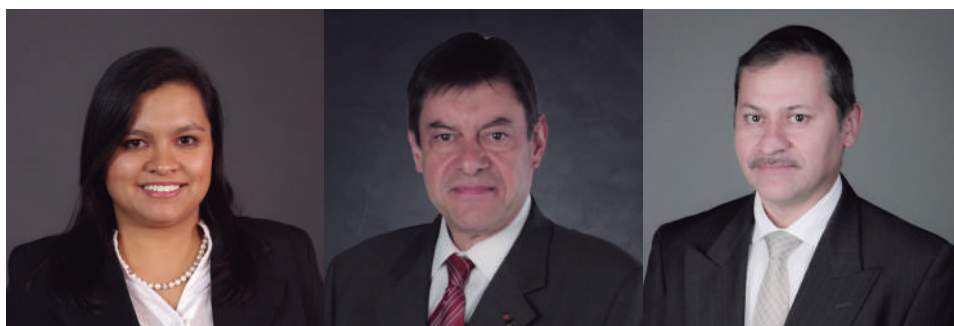
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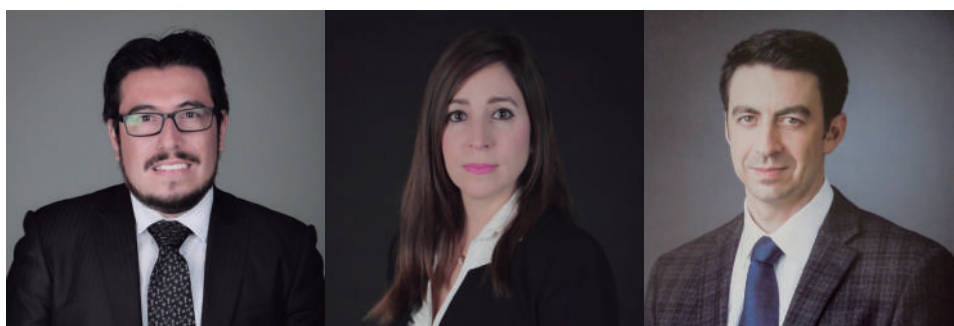
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AN ALTERNATIVE METHOD FOR SHAKING FORCE BALANCING OF THE 3RRR PPM THROUGH ACCELERATION CONTROL OF THE CENTER OF MASS

ABSTRACT. The problem of shaking force balancing of robotic manipulators, which allows the elimination or substantial reduction of the variable force transmitted to the fixed frame, has been traditionally solved by optimal mass redistribution of the moving links. The resulting configurations have been achieved by adding counterweights, by adding auxiliary structures or, by modifying the form of the links from the early design phase. This leads to an increase in the mass of the elements of the mechanism, which in turn leads to an increment of the torque transmitted to the base (the shaking moment) and of the driving torque. Thus, a balancing method that avoids the increment in mass is very desirable. In this article, the reduction of the shaking force of robotic manipulators is proposed by the optimal trajectory planning of the common center of mass of the system, which is carried out by "bang-bang" profile. This allows a considerable reduction in shaking forces without requiring counterweights, additional structures, or changes in form. The method, already presented in the literature, is resumed in this case using a direct and easy to automate modeling technique based on fully Cartesian coordinates. This permits to express the common center of mass, the shaking force, and the shaking moment of the manipulator as simple analytic expressions. The suggested modeling procedure and balancing technique are illustrated through the balancing of the 3RRR planar parallelmanipulator (PPM). Results fromcomputer simulations are reported. © 2020 by the authors.

Acevedo, M., Orvañanos-Guerrero, M. T., Velázquez, R., & Arakelian, V. (2020). An alternative method for shaking force balancing of the 3RRR PPM through acceleration control of the center of mass. *Applied Sciences (Switzerland)*, 10(4), 1351. doi: 10.3390/app10041351. Article.

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FORCE BALANCING OF THE 2RRR PLANAR PARALLEL MANIPULATOR VIA CENTER OF MASS ACCELERATION CONTROL USING FULLY CARTESIAN COORDINATES

ABSTRACT. Shaking force balancing of mechanisms usually is achieved by an optimal redistribution of the moving masses, which allows the cancellation or the reduction of the variable dynamic loads on the manipulator's frame. This procedure usually leads to an increase in the mass of the original links, motivating the increment on the driving torques and on the shaking moment. In this article the concept of center of mass acceleration control, presented previously elsewhere, is resumed this time with the use of fully Cartesian coordinates. The trajectory of the general center of mass of the system, calculated out from the motion of the moving links, is defined as straight line and characterized with a "bang-bang" profile. In this way it is possible to reduce the maximum acceleration of the center of mass thus, reducing the shaking force. The suggested balancing technique is illustrated through computer simulations. © 2020, The Editor(s) (if applicable) and The Author(s), under exclusive license to Springer Nature Switzerland AG.

Acevedo, M. & Orvañanos-Guerrero, M. T. (2020). Force Balancing of the 2RRR Planar Parallel Manipulator Via Center of Mass Acceleration Control Using Fully Cartesian Coordinates. In Cecarelli, M. (ed.), *Mechanisms and Machine Science*, vol. 86 (pp. 25-35). Cham, Switzerland: Springer. doi: 10.1007/978-3-030-45402-9_4. Book Chapter.

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MULTIBODY DYNAMICS FOR HUMAN-LIKE LOCOMOTION

ABSTRACT. Multibody dynamics has been a fundamental tool for modeling, simulation and design of human-like locomotion systems. Either in the prosthetic and orthotics sector to develop devices for improvement or restoration of mobility, or as in the simulation, design, and optimization of humanoid robots. A lot of research and development has been done in these challenging areas where new mechanisms and improvements in dynamics are always welcome. The dynamic balancing of mechanisms

(force and moment balancing at the fixed base) is an area that, along with multibody dynamics, can help to improve the design of human-like locomotion systems. In this chapter, the application of a force-balanced mechanism is proposed as a leg to be part of a biped robot. Stability is analyzed through the application of learning approaches based on an artificial intelligence, namely artificial hydrocarbon networks. Modeling and results from multibody dynamics simulation are presented. © 2020 Elsevier Inc. All rights reserved.

Acevedo, M. & Ponce, H. (2019). Multibody dynamics for human-like locomotion. In Cecarelli N. & Carbone G. (eds.), *Design and Operation of Human Locomotion Systems*, (pp. 51-81). London, UK: Academic Press. doi: 10.1016/B978-0-12-815659-9.00003-2. Book Chapter.

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AUTOMATING THE AVOCADO SUPPLY CHAIN WITH BLOCKCHAIN AND OFF-CHAIN

ABSTRACT. Currently, there is a lack of transparency of goods from avocado producers to the final destination: consumers. In this work, we take on the task of using Blockchain technology to strengthen trust among members of an avocado supply chain, providing more transparency across the value chain and creating value for stakeholders. We maintain transparency, integrity, and reliability of the data as a key problem, from a technological perspective. The proposed solution takes advantage of blockchain and classification of geospatial images to properly track the assets. © Interconnected Supply Chains in an Era of Innovation - Proceedings of the 8th International Conference on Information Systems, Logistics and Supply Chain, ILS 2020. All rights reserved.

López-Pimentel, J. C., Rojas, O., Alcaraz-Rivera, M., Sosa-Gómez, G., & Verteramo-Chiu, L. (2020). Automating the avocado Supply Chain with Blockchain and Off-chain. *ILS2020. 8th International Conference on Information Systems, Logistics and Supply Chain: Interconnected Supply Chains in an Era of Innovation* (United States), Austin (pp. 292-298). Conference Paper.

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A PRICE-MAKER/PRICE-TAKER MODEL FOR THE OPERATION OF BATTERY STORAGE SYSTEMS IN ELECTRICITY MARKETS

ABSTRACT. The goal of this paper is to develop models for estimating the potential profit of a battery storage system that provides multiple services in a competitive electricity market. We assume the size of the battery is small relative to the energy market volume and its actions do not impact the energy market outcomes; thus, it is a price-taker in the energy market. However, considering the relatively smaller market volume for ancillary services, we consider the battery's strategies to impact the outcomes of the markets for frequency regulation service, spinning reserve, and non-spinning reserve. An optimization model is proposed considering the uncertainties in energy prices, the offers of ancillary services by competitors, and the energy deployment in ancillary services markets. We employ robust and stochastic optimization approaches to account for the different nature of each uncertain variable. The scheduling is done in day-ahead and is later refined closer to real time. Numerical results are provided based on real-life data. © 2010-2012 IEEE.

Arteaga, J. & Zareipour, H. (2019). A Price-Maker/Price-Taker Model for the Operation of Battery Storage Systems in Electricity Markets. *IEEE Transactions on Smart Grid*, 10(6), 6912-6920. doi: 10.1109/TSG.2019.2913818. Article.

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HEAT TRANSFER COEFFICIENT PREDICTION OF A POROUS MATERIAL BY IMPLEMENTING A MACHINE LEARNING MODEL ON A CFD DATA SET

ABSTRACT. During many years, the search for new and improved materials has been an arduous task. It has mainly focused on experimentation and in recent years on computer aided techniques (i.e. numerical simulation). These two approaches defined the way material science works. Yet, both techniques have shown cost-efficiency disadvantages. Optimization algorithms, like the ones used in machine learning, have proven to be an alternative tool when dealing with lots of data and finding a particular solution. Even though the use of machine learning is a well established technique in other fields, its application in material science is relatively new. Material Informatics provides a new approach to analyse materials such as porous metals by employing previous data sets. This paper studies a new technique to predict the heat transfer coefficient of an open-

cell porous structure while running water passes through the material. A CFD data set was employed by a Machine Learning technique in order to establish a relationship between the input parameters (porosity, pore size, pore distribution and flow rate) and the heat transfer coefficient of the sample. The results obtained from the analyses were compared with previous findings, concluding that by utilising a Machine Learning technique is possible to obtain a more accurate and much better fit model. © 2019, Avestia Publishing.

Avalos-Gauna, E. & Palafox-Novack, L. (2019). Heat transfer coefficient prediction of a porous material by implementing a machine learning model on a CFD data set. *FFHMT 2019*. 6th International Conference on Fluid Flow, Heat and Mass Transfer (Canada), Ottawa (pp. 1-10). doi: 10.1159/ffhmt19.149. Conference Paper.

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BIODEGRADABLE POLYMER OBTAINED FROM ORANGE PEELS

ABSTRACT. In order to achieve a reduction in the use of disposable plastic packaging made from petroleum derivatives the use of organic wastes converted into biodegradable polymers is an opportunity. Therefore, the main objective of this research was to obtain a biopolymer developed through the conversion of orange peels. The use of tree structures allowed relating different variables that could have influence in the formulation of bioplastics. The variables that had more weight are the ratios of starch used in the formulation, the method to cool down the mix, and the drying method. In order to achieve the best biopolymer, the best variables were the use starch 100%, cooling at room temperature and dehydration for drying. The results can contribute to create a circular economy and will protect the environment. © 2019 IEEE.

Berger, P., Cachutt-Alvarado, C., Fraustro-Ortega, D., Macías-Ochoa, M. F., Domínguez-Soberanes, J., & Hernández-Lozano, L. C. (2019). Biodegradable Polymer Obtained from Orange Peels. *2019 IEEE*. 2019 IEEE 39th Central America and Panama Convention (CONCAPAN XXXIX) (Guatemala), Guatemala City (pp. 1-6). doi: 10.1109/CONCAPANXXXIX47272.2019.8977093. Conference Paper.

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3D HERMITE TRANSFORM OPTICAL FLOW ESTIMATION IN LEFT VENTRICLE CT SEQUENCES

ABSTRACT. Heart diseases are the most important causes of death in the world and over the years, the study of cardiac movement has been carried out mainly in two dimensions, however, it is important to consider that the deformations due to the movement of the heart occur in a three-dimensional space. The 3D + t analysis allows to describe most of the motions of the heart, for example, the twisting motion that takes place on every beat cycle that allows us identifying abnormalities of the heart walls. Therefore, it is necessary to develop algorithms that help specialists understand the cardiac movement. In this work, we developed a new approach to determine the cardiac movement in three dimensions using a differential optical flow approach in which we use the steered Hermite transform (SHT) which allows us to decompose cardiac volumes taking advantage of it as a model of the human vision system (HVS). Our proposal was tested in complete cardiac computed tomography (CT) volumes (3D + t), as well as its respective left ventricular segmentation. The robustness to noise was tested with good results. The evaluation of the results was carried out through errors in forwarding reconstruction, from the volume at time t to time t + 1 using the optical flow obtained (interpolation errors). The parameters were tuned extensively. In the case of the 2D algorithm, the interpolation errors and normalized interpolation errors are very close and below the values reported in ground truth flows. In the case of the 3D algorithm, the results were compared with another similar method in 3D and the interpolation errors remained below 0.1. These results of interpolation errors for complete cardiac volumes and the left ventricle are shown graphically for clarity. Finally, a series of graphs are observed where the characteristic of contraction and dilation of the left ventricle is evident through the representation of the 3D optical flow. © 2020 by the authors. Licensee MDPI, Basel, Switzerland.

Mira, C., Moya-Albor, E., Escalante-Ramírez, B., Olveres, J., Brievea, J., & Vallejo, E. (2020). 3D hermite transform optical flow estimation in left ventricle CT sequences. *Sensors (Switzerland)*, 20(3), 595. doi: 10.3390/s20030595. Article.

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A CONTACTLESS RESPIRATORY RATE ESTIMATION METHOD USING A HERMITE MAGNIFICATION TECHNIQUE AND CONVOLUTIONAL NEURAL NETWORKS

ABSTRACT. The monitoring of respiratory rate is a relevant factor in medical applications and day-to-day activities. Contact sensors have been used mostly as a direct solution and they have shown their effectiveness, but with some disadvantages for example in vulnerable skins such as burns patients. For this reason, contactless monitoring systems are gaining increasing attention for respiratory detection. In this paper, we present a new non-contact strategy to estimate respiratory rate based on Eulerian motion video magnification technique using Hermite transform and a system based on a Convolutional Neural Network (CNN). The system tracks chest movements of the subject using two strategies: using a manually selected ROI and without the selection of a ROI in the image frame. The system is based on the classifications of the frames as an inhalation or exhalation using CNN. Our proposal has been tested on 10 healthy subjects in different positions. To compare performance of methods to detect respiratory rate the mean average error and a Bland and Altman analysis is used to investigate the agreement of the methods. The mean average error for the automatic strategy is $3.28 \pm 3.33\%$ with and agreement with respect of the reference of 98%. © 2020 by the authors.

Brieva, J., Ponce, H., & Moya-Albor, E. (2020). A contactless respiratory rate estimation method using a hermite magnification technique and convolutional neural networks. *Applied Sciences (Switzerland)*, 10(2), 607. doi: 10.3390/app10020607. Article.

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A PERCEPTIVE WATERMARKING APPROACH APPLIED TO COVID-19 IMAGING DATA

ABSTRACT. This work presents a watermarking algorithm applied to medical images of COVID-19 patients. The principal objective is to protect the information of the patient using an imperceptible watermarking and to preserve its diagnose. Our technique is based on a perceptive approach to insert the watermark by decomposing the medical image using the Hermite transform. We use as watermark two image logos, including text strings to demonstrate that the watermark can contain relevant information of the patient. Some metrics were applied to evaluate the performance of the algorithm. Finally, we present some results about robustness with some attacks applied to watermark images. © 2020 SPIE.

Gomez-Coronel S. L., Moya-Albor E., Brieva J., & Ponce H. (2020). A perceptive watermarking approach applied to COVID-19 imaging data. *Proceedings of SPIE. 16th International Symposium on Medical Information Processing and Analysis (Peru)*, Lima. doi: 10.1117/12.2579766. Conference Paper.

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AN INTELLIGENT HUMAN FALL DETECTION SYSTEM USING A VISION-BASED STRATEGY

ABSTRACT. Elderly people is increasing dramatically during the current years, and it is expected that this population reaches 2.1 billion of individuals by 2050. In this regard, new care strategies are required. Assisted living technologies have proposed alternatives to support professional caregivers and families to take care of elderly people, such as in risk of falls. Currently, fall detection systems are able to alleviate the latter problem and reduce the time a person who suffered a fall receives assistance. Thus,

this paper proposes a fall detection system based on image processing strategy to extract motion features through an optical flow method. For classification, we use these features as inputs to a convolutional neural network. We applied our approach in a dataset comprises video recordings of one subject performing different types of falls. In experimental results, our approach showed 92% accuracy on the dataset used.

Brieva, J., Ponce, H., Moya-Albor, E., & Martínez-Villaseñor, L. (2019). An Intelligent Human Fall Detection System Using a Vision-Based Strategy. 2019 IEEE. 14th IEEE International Symposium on Autonomous Decentralized Systems (SADS) (Netherlands), Utrecht (pp. 1-5). doi: 10.1109/ISADS45777.2019.9155767. Conference Paper. © 2019 IEEE.

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APPLICATION OF CONVOLUTIONAL NEURAL NETWORKS FOR FALL DETECTION USING MULTIPLE CAMERAS

ABSTRACT. Currently one of the most important research issue for artificial intelligence and computer vision tasks is the recognition of human falls. Due to the current exponential increase in the use of cameras is it common to use vision-based approach for fall detection and classification systems. On another hand deep learning algorithms have transformed the way that we see vision-based problems. The Convolutional Neural Network (CNN) as deep learning technique offers more reliable and robust solutions on detection and classification problems. Focusing only on a vision-based approach, for this work we used images from a new public multimodal data set for fall detection (UP-Fall Detection dataset) published by our research team. In this chapter we present fall detection system using a 2D CNN analyzing multiple camera information. This method analyzes images in fixed time window frames extracting features using an optical flow method that obtains information of relative motion

between two consecutive images. For experimental results, we tested this approach in UP-Fall Detection dataset. Results showed that our proposed multi-vision-based approach detects human falls achieving 95.64% in accuracy with a simple CNN network architecture compared with other state-of-the-art methods. © 2020, Springer Nature Switzerland AG.

Espinosa, R., Ponce, H., Gutiérrez, S., Martínez-Villaseñor, L., Brieva, J., & Moya-Albor, E. (2020). Application of Convolutional Neural Networks for Fall Detection Using Multiple Cameras. In Kacprzyk, J. (ed.), *Studies in Systems, Decision and Control*, vol. 273 (pp. 97-120). Cham, Switzerland: Springer. doi: 10.1007/978-3-030-38748-8_5. Book Chapter.

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BIO-INSPIRED OPTICAL FLOW-BASED AUTONOMOUS OBSTACLE AVOIDANCE CONTROL

ABSTRACT. In this paper, we propose a new methodology for autonomous obstacle avoidance control using a bio-inspired optical flow estimation. The main difference with other methods is that we use an image model inspired by the human vision system to define the constraints in the optical flow formulation which includes a Hermite transform (HT) and a perceptive mask. We use a physical robot platform to test the control algorithm, where due to the structure of the chassis a forward, reverse and turn movements were defined. The robot has a RGB camera to capture images of the path and then calculate optical flow estimation. To define velocity and direction robot response we propose a fuzzy controller. Finally, we made some experiments to demonstrate the performance of control navigation, and how responds algorithm using HT and a perceptive mask. © 2019 IEEE.

Moya-Albor, E., Coronel, S. L., Ponce, H., Brieva, J., Chavez-Dominguez, R., & Guadarrama-Munoz, A. E. (2019). Bio-inspired optical flow-based autonomous obstacle avoidance control. 2019 IEEE. 2019 International Conference on Mechatronics, Electronics and Automotive Engineering (ICMEAE 2019) (Mexico), Cuernavaca (pp. 18-23). doi: 10.1109/ICMEAE.2019.00011. Conference Paper.

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GABOT: GARBAGE AUTONOMOUS COLLECTOR FOR INDOORS AT LOW COST

ABSTRACT. The constant raise in the levels of garbage in our city contributes to the worldwide pollution nowadays and this becoming a health issue for the entire world. Another problem is to avoid more garbage collectors get ill because of the exposure they have to solid wastes that can make them have health issues. This lead us to design a garbage collector that can move around looking for garbage and can store it in a specific container. It will have a manipulator that will be moving thanks to a vehicle that can avoid obstacles. A camera will detect the garbage whenever it is in front of it and the manipulator will take it. In this work we propose a proof of concept of a mechatronic system that can detect and pick up garbage on a zone using a camera and sensors. © 2019 IEEE.

Mayorga, C., Gómez, C., Díaz, G., Vázquez, C., Kobayashi, R., Brieva, J., Ponce, H., & Moya-Albor, E. (2019). GABOT: Garbage autonomous collector for indoors at low cost. *2019 IEEE. 2019 International Conference on Mechatronics, Electronics and Automotive Engineering (ICMEAE 2019)* (Mexico), Cuernavaca. (pp. 56-61). doi: 10.1109/ICMEAE.2019.00018. Conference Paper.

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NON-CONTACT BREATHING RATE MONITORING SYSTEM USING A MAGNIFICATION TECHNIQUE AND ARTIFICIAL HYDROCARBON NETWORKS

ABSTRACT. In this paper, we present a new non-contact strategy to estimate the breathing rate based on the Eulerian motion video magnification technique and an Artificial Hydrocarbon Networks (AHN) as classifier. After the magnification procedure, a AHN is trained to detect the inhalation and exhalation frames in the video. From this classification, the respiratory rate is estimated. The magnification procedure was carried out using the Hermite decom-

position. The respiratory rate (RR) is estimated from the classified frames. We have tested the method on 10 healthy subjects in different positions. To compare performance of methods to respiratory rate the mean average error and a Bland and Altman analysis is used to investigate the agreement of the methods. The mean average error for our strategy is $4.46 \pm 3.68\%$ with and agreement with respect of the reference of $\sim 98\%$. © 2020 SPIE.

Brieva J., Ponce H., & Moya-Albor E. (2020). Non-Contact Breathing Rate Monitoring System using a Magnification Technique and Artificial Hydrocarbon Networks. *Proceedings of SPIE. 16th International Symposium on Medical Information Processing and Analysis (Peru)*, Lima. doi: 10.1117/12.2580077. Conference Paper.

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NON-CONTACT BREATHING RATE MONITORING SYSTEM USING A MAGNIFICATION TECHNIQUE AND CONVOLUTIONAL NETWORKS

ABSTRACT. In this paper, we present a new non-contact strategy to estimate the breathing rate based on the Eulerian motion video magnification technique and a system based on a Convolutional Neural Network (CNN). After the magnification procedure, a CNN is trained to detect the inhalation and exhalation frames in the video. From this classification, the respiratory rate is estimated. The magnification procedure was carried out using the Hermite decomposition. Two strategies are used as input to the CNN. A CNN-ROI proposal where a region of interest is selected manually on the image frame and in the second case, a CNN-Whole-Image proposal where the entire image frame is selected. Finally, the RR is estimated from the classified frames. The CNN-ROI proposal is tested on five subjects in lying face down position and it is compared to a procedure using different image processing steps to tag the frames as inhalation or exhalation. The mean average error in percentage obtained for this proposal is $2.326 \pm 1.144\%$. The CNN-whole-image proposal is tested on eight subjects in lying face down position. The mean average error in percentage obtained for this proposal is $2.115 \pm 1.135\%$. © COPY-RIGHT SPIE. Downloading of the abstract is permitted for personal use only.

Brieva, J., Ponce, H., & Moya-Albor, E. (2020). Non-contact breathing rate monitoring system using a magnification technique and convolutional networks. *Proceed-*

ings of SPIE. 15th International Symposium on Medical Information Processing and Analysis (SIPAIM 2019) (Colombia), Medellin. doi: 10.1117/12.2542336. Conference Paper.

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NUCLEAR DENSITY ANALYSIS IN MICROSCOPIC IMAGES FOR THE CHARACTERIZATION OF RETINAL GEOGRAPHIC ATROPHY

ABSTRACT. Age-related macular degeneration (AMD) is the leading cause of irreversible blindness in industrialized countries. It is estimated that AMD affects at least 1 in 10 Hispanics. Previous reports have shown that AMD has multiple risk factors. Recently, we demonstrated that some genetic variants in the SGCD gene are involved in AMD developments, especially in early-stage (geographic atrophy, GA). Therefore, to evaluate the relationship between SGCD's absence and the loss of photoreceptors in GA, we worked with a genetically modified mouse model, SGCD deficient (Sgcd^{-/-}) and a control mouse C57BL/6J (Sgcd^{+/+}). First, we obtained hematoxylin and eosin (H&E) retina staining microscopic images. Then, we coarsely selected the outer and inner nuclear retinal layer (ONL and INL respectively) and finally, we applied an automatic nuclei segmentation to calculate the nuclear density in each region. Our results showed that Sgcd absence does not result in photoreceptor loss, on the contrary, it promotes an increment in nuclear density by 8.7% in ONL and 20.1% in INL compared with control eyes ($p = 0.0033$ and $p < 0.0001$ respectively). This could be explained by the fact that SGCD codifies the delta-sarcoglycan protein and there is evidence that showed a relationship between the absence of this protein with the activation of a cell proliferation signaling pathway. Finally, our results show that the delta-sarcoglycan protein could play an important role in the pathogenesis of the geographic atrophy. Moreover, there are promising perspectives for the systematic approach applied for cell image analysis, as an important tool to determine the nuclear density for

assessing the progression of AMD. © COPYRIGHT SPIE. Downloading of the abstract is permitted for personal use only.

Peralta-Ildefonso, M. J., Moya-Albor, E., Brieva, J., Lira-Romero, E., Pérez-Ortiz, A. C., Coral-Vázquez, R., & Estrada-Mena, F. J. (2020). Nuclear density analysis in microscopic images for the characterization of retinal geographic atrophy. *Proceedings of SPIE. 15th International Symposium on Medical Information Processing and Analysis* (Colombia), Medellin. doi: 10.1117/12.2542061. Conference Paper.

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OPEN SOURCE IMPLEMENTATION FOR FALL CLASSIFICATION AND FALL DETECTION SYSTEMS

ABSTRACT. Distributed social coding has created many benefits for software developers. Open source code and publicly available datasets can leverage the development of fall detection and fall classification systems. These systems can help to improve the time in which a person receives help after a fall occurs. Many of the simulated falls datasets consider different types of fall however, very few fall detection systems actually identify and discriminate between each category of falls. In this chapter, we present an open source implementation for fall classification and detection systems using the public UP-Fall Detection dataset. This implementation comprises a set of open codes stored in a GitHub repository for full access and provides a tutorial for using the codes and a concise example for their application. © 2020, Springer Nature Switzerland AG.

Ponce, H., Martínez-Villaseñor, L., Núñez-Martínez, J., Moya-Albor, E., & Brieva, J. (2020). Open Source Implementation for Fall Classification and Fall Detection Systems. In Kacprzyk, J. (ed.), *Studies in Systems, Decision and Control*, vol. 273 (pp. 3-29). Cham, Switzerland: Springer. doi: 10.1007/978-3-030-38748-8_1. Book Chapter.

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STAIR CLIMBING ROBOT BASED ON CONVOLUTIONAL NEURAL NETWORKS FOR VISUAL IMPAIRED

ABSTRACT. When a person loses the sense of sight, in general, it is suggested to use a white cane to perform daily activities. However, using a white cane limits the movement of a person. In addition, guide dogs can be served in this impairment. However, the acquisition and maintenance of a guide dog is extremely high for people in development countries. In this regard, this paper presents a proof-of-concept of a low-cost robotic system able to guide a visual impaired, as a guide dog. The robot is specially designed for climbing stairs at indoors, and it uses convolutional neural networks (CNN) for both object detection and hand gesture recognition for special instructions from the user. Experimental results showed that our prototype robot can climb stairs with 86.7% of efficiency in concrete stair surfaces. Also, the visual representation by CNN performed more than 98% accuracy. © 2019 IEEE.

Campos, G., Poza, D., Reyes, M., Zacate, A., Ponce, H., Brieva, J., & Moya-Albor, E. (2019). Stair climbing robot based on convolutional neural networks for visual impaired. *IEEE. 2019 International Conference on Mechatronics, Electronics and Automotive Engineering (ICMEAE 2019)* (Mexico), Cuernavaca (pp. 108-113). doi: 10.1109/ICMEAE.2019.00027. Conference Paper.

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Investigador Titular D, SNI Nivel I

VISION-BASED ANALYSIS ON LEAVES OF TOMATO CROPS FOR CLASSIFYING NUTRIENT DEFICIENCY USING CONVOLUTIONAL NEURAL NETWORKS

ABSTRACT. Tomato crops are one of the most important agricultural products at economic level in the world. However, the quality of the tomato

fruits is highly dependent to the growing conditions such as the nutrients. One of consequences of the latter during tomato harvesting is nutrient deficiency. Manually, it is possible to anticipate the lack of primary nutrients (i.e. nitrogen, phosphorus and potassium) by looking the appearance of the leaves in tomato plants. Thus, this paper presents a supervised vision-based monitoring system for detecting nutrients deficiencies in tomato crops by taking images from the leaves of the plants. It uses a Convolutional Neural Network (CNN) to recognize and classify the type of nutrient that is deficient in the plants. First, we created a data set of images of leaves of tomato plants showing different symptoms due to the nutrient deficiency. Then, we trained a suitable CNN-model with our images and other augmented data. Experimental results showed that our CNN-model can achieve 86.57% of accuracy. We anticipate the implementation of our proposal for future precision agriculture applications such as automated nutrient level monitoring and control in tomato crops. © 2020 IEEE.

Cevallos C., Ponce H., Moya-Albor E., & Brieva J. (2020). Vision-Based Analysis on Leaves of Tomato Crops for Classifying Nutrient Deficiency using Convolutional Neural Networks. *2020 IEEE. 2020 International Joint Conference on Neural Networks (IJCNN 2020)* (United Kingdom), Glasgow. doi: 10.1109/IJCNN48605.2020.9207615. Conference Paper.

Fabiola Cortés Chávez
Profesor investigador

BIRTHING BED DESIGN PROCESS FOR NEW MOTHERS, CONSIDERING ALL THE USERS INVOLVED AT DELIVERY PHASE: CASE STUDY IN MEXICO

ABSTRACT. The objective of this study is to demonstrate the innovation and design process of a birthing bed, designed specifically for young first mothers [1]. This problem was chosen due to the social and cultural conditions nowadays in Mexico, which, according to data from the INEGI, National Institute of Geography and Statistics, around 32 million women over 12 years old pursue their motherhood [2]. Not only are the numbers alarming, but it must be addressed the fact that a poorly attended delivery can be truly traumatic. The data collected by primary sources is a series of surveys sent to mothers, doctors and nurses, in which they are questioned about their experience before, during and after delivery. They were also questioned about recommendations regarding actual delivery beds. Data collection via internet focused mainly in complementing the formation obtained in the surveys. The data in this investigation includes the complete process of a delivery, the actual birthing beds and the role of each user within a delivery. © 2021, The

Editor(s) (if applicable) and The Author(s), under exclusive license to Springer Nature Switzerland AG.

Suárez-Gómez, G. D., Robles-Barba, A., Avelar-Enciso, M., Garnier-Ortiz, C. R., & Cortes-Chávez, F. (2021). Birthing Bed Design Process for New Mothers, Considering All the Users Involved at Delivery Phase: Case Study in Mexico. In Ahram, T., Karwowski, W., Pickl, S., & Taiar, R. (eds.), *Human Systems Engineering and Design II. IHSED 2020. Advances in Intelligent Systems and Computing*, vol 1269 (pp. 162-167). Cham, Switzerland: Springer. doi: 10.1007/978-3-030-58282-1_26. Book Chapter.

Fabiola Cortés Chávez

Profesor investigador

BIRTHING BED WITH ERGONOMIC DESIGN OF ADJUSTABLE SECTIONS BY TOUCH TECHNOLOGY THAT FACILITATES ITS UNDERSTANDING AND USE

ABSTRACT. Labor is a complex process in which one of the main factors within the hospital's context is the medical equipment that helps to carry out the work, such as the birthing bed. Is around it that the activities that allow an efficient labor are carry out. There are two main approaches when it comes to medical design, known as EBD (Evidence-Based Design) and UCD (User-Centered Design). Each one seeks to meet different expectations and functions with the design each supports. This article presents a comparative analysis on the design of a birthing bed using both approaches, aiming to know if an user-centered design methodology helps increase the satisfaction of the users, by improving the bed's ease of use and understanding. © 2021, The Editor(s) (if applicable) and The Author(s), under exclusive license to Springer Nature Switzerland AG.

Bátiz-Flores, T., Pérez, A., Martínez-López, M. F., Cortes-Chávez, F., & Garnier-Ortiz, C. R. (2021). Birthing Bed with Ergonomic Design of Adjustable Sections by Touch Technology that Facilitates Its Understanding and Use. In Karwowski, W., Ahram, T., Etinger, D., Tanković, N., & Taiar, R. (eds.), *Human Systems Engineering and Design III. IHSED 2020. Advances in Intelligent Systems and Computing*, vol. 1269 (pp.174-179). Cham, Switzerland: Springer. doi: 10.1007/978-3-030-58282-1_28. Book Chapter.

Fabiola Cortés Chávez

Profesor investigador

Luis Alberto Rosa Sierra

SNI Nivel II

DESIGN AND DEVELOPMENT OF AN ALL-TERRAIN WHEELCHAIR FOR RURAL AREAS IN MEXICO: THE FIRST STAGE OF THE PROJECT

ABSTRACT. Estimates that around 10% of the world's population, some 650 million people have some disability. Studies indicate that about 10% of these people need a wheelchair to move. Therefore, estimates that 1% of the total population requires a wheelchair, about 65 million people worldwide. Calculations by the UN show that 80% of that amount lives in developing countries. In 2010 it was estimated that 20 million of those who needed a wheelchair to get around did not have one. In developing countries, moreover, chairs are required to allow people with disabilities to move through irregular surfaces since they either live in the countryside, or in cities where the infrastructure is not adequate, and there are no sidewalks, ramps or wheelchair facilities. From this problem arises the need for the design and development of an all-terrain wheelchair of low cost and simple manufacturing, which allows its reproduction in almost any developing country. © 2020, The Editor(s) (if applicable) and The Author(s), under exclusive license to Springer Nature Switzerland AG.

Rossa-Sierra, A., Diaz-Pinal, A. P., Cortes-Chávez, F., de la Fuente, F. M., & Carrillo-Alvarado, G. (2020). Design and Development of an All-Terrain Wheelchair for Rural Areas in Mexico: The First Stage of the Project. In Di Bucchianico G., Shin C., Shim S., Fukuda S., Montagna G., Carvalho C. (eds.), *Advances in Industrial Design. AHFE 2020. Advances in Intelligent Systems and Computing*, vol 1202 (pp. 124-130). Cham, Switzerland: Springer. doi: 10.1007/978-3-030-51194-4_17. Book Chapter.

Fabiola Cortés Chávez

Profesor investigador

Luis Alberto Rosa Sierra

SNI Nivel II

EMOTIONAL DESIGN AND HUMAN FACTORS DESIGN AS TOOL FOR UNDERSTANDING EFFICIENCY IN INFORMATION DESIGN PROCESS AT MEDICAL DOCUMENTS

ABSTRACT. This work will focus on improving the design that currently has medical documents, specifically results of blood chemistry used in Mexico, which are not designed to be understood by the different users who really interact with this product. It is important to propose a taxonomy of the different users that interact with the documents that corre-

spond to the results of clinical analysis, in order to develop products that are focused on the cognitive requirements of each of them. © 2020, The Editor(s) (if applicable) and The Author(s), under exclusive license to Springer Nature Switzerland AG.

García-Hernández, M., Cortés-Chávez, F., Marin-Álvarez, M., Rossa-Sierra, A., & González, E. L. (2020). Emotional Design and Human Factors Design as Tool for Understanding Efficiency in Information Design Process at Medical Documents. In Di Bucchianico G., Shin C., Shim S., Fukuda S., Montagna G., Carvalho C. (eds.), *Advances in Industrial Design. AHFE 2020. Advances in Intelligent Systems and Computing*, vol 1202 (pp.157-163). Cham, Switzerland: Springer. doi: 10.1007/978-3-030-51194-4_21. Book Chapter.

Fabiola Cortés Chávez

Profesor investigador

EXPULSION STRETCHER FOR BIRTHS IN INDIGENOUS COMMUNITIES

ABSTRACT. The objective of this document is to show the development of the design of a portable birthing stretcher that facilitates the process of birthing in the indigenous communities of Mexico, to both the midwives and the mothers since the current conditions of birthing in the aforementioned place is insufficient to make it a safe and a comfortable delivery, it is worth mentioning that the midwives travel distances to be able to assist the mothers. For the design, we sought to ensure that it would not complicate the midwife's transportation, but that it would also be a tool to transport all the necessary utensils for safe and hygienic delivery, as well as a device that would help with the mother's posture so that she would be more comfortable during the delivery and would also help with the midwife to make it safer [1, 2]. © 2021, The Editor(s) (if applicable) and The Author(s), under exclusive license to Springer Nature Switzerland AG.

Díaz-Pinal, M., Ramírez-Reynoso, J., Ascencio-Murillo, M., Chavira-Hernández, G. A., Cortés-Chávez, F., & Garnier-Ortiz, C. (2021). Expulsion Stretcher for Births in Indigenous Communities. In Karwowski W., Ahram T., Ettinger D., Tanković N., Taiar R. (eds.), *Human Systems Engineering and Design III. IHSED 2020. Advances in Intelligent Systems and Computing*, vol 1269 (pp. 168-173). Cham, Switzerland: Springer. doi: 10.1007/978-3-030-58282-1_27. Book Chapter.

Fabiola Cortés Chávez

Profesor investigador

Luis Alberto Rosa Sierra

SNI Nivel II

HIERARCHY OF THE USERS AROUND THE BIRTHING BED, ANALYSIS FOR FURNITURE REDESIGN

ABSTRACT. Analysis of hierarchical tasks in the hospital on the delivery phase, Users who interact with a delivery bed, to understand the usability of the object and the patterns of use, to identify possible improvements for the future bed design process. This paper argues that the use of the delivery bed requires further study of the number of users, their characteristics and hierarchy of use around the bed during labour, in order to consider the users who actually use the object for the improvement of the future design. A web study was conducted on 32 videos chosen for convenience, on YouTube, showing the birthing process. Each user was counted and characterized around the delivery bed, as well as the tasks they performed around the bed during the delivery phase. In the number of users the average was 6.8 Everyone was ranked according to who had the most interaction with the product. © The Editor(s) (if applicable) and The Author(s), under exclusive license to Springer Nature Switzerland AG 2020.

Cortés-Chávez, F., Díaz-Pinal, A., Rossa-Sierra, A., Garnier, C., Gonzalez-Muñoz, E. L. (2020). Hierarchy of the users around the birthing bed, analysis for furniture redesign. In Rebelo, F., Soares, M. (eds.), *Advances in Ergonomics in Design. AHFE 2020. Advances in Intelligent Systems and Computing*, vol 1203 (pp. 356-361). Cham, Switzerland: Springer. doi: 10.1007/978-3-030-51038-1_49. Book Chapter.

Fabiola Cortés Chávez

Profesor investigador

Luis Alberto Rosa Sierra

SNI Nivel II

INTEGRATION OF CONSUMER ELECTRONICS PRODUCTS DESIGNED IN MEXICO

ABSTRACT. In Mexico, Jalisco has developed along four decades an important infrastructure to initially manufacture electronic components, and over time, being able to transition to a design sector in a joint effort between government, electronics industry and universities. As a result, product design should be included to deliver complete consumer electronics solutions while taking in consideration diverse aspects such as functionality, ease of use, brand positioning, aesthetics and emotional aspects.

However, unlike transnational corporations this has not occurred to the electronic sector in Mexico. This paper will intent to explain the missing link between consumer electronics companies that are not benefiting from the insertion of industrial design to generate complete solutions. © 2020, The Editor(s) (if applicable) and The Author(s), under exclusive license to Springer Nature Switzerland AG.

Garnier-Ortiz, C., Rossa-Sierra, A., & Cortés-Chávez, F. (2020). Integration of Consumer Electronics Products Designed in Mexico. In Di Bucchianico G., Shin C., Shim S., Fukuda S., Montagna G., & Carvalho C. (eds.), *Advances in Industrial Design. AHFE 2020. Advances in Intelligent Systems and Computing*, vol 1202 (pp. 551-557). Cham, Switzerland: Springer. doi: 10.1007/978-3-030-51194-4_72. Book Chapter.

Fabiola Cortés Chávez

Profesor investigador

Luis Alberto Rosa Sierra

SNI Nivel II

MENTAL HEALTH IN DIFFERENT COLLEGE EDUCATION SYSTEMS

ABSTRACT. Over the years, there has been an increased severity and complexity of mental health problems among college students all over the world, emphasizing in Mexico and China. The focus of this research is to investigate the mental health of Chinese and Mexican students through a nationwide sample. The researchers employed secondary data analysis, data from the American College Health Association-National College Health Assessment, students' demographic information was computed and separated, and research questions were analyzed with specific descriptive statistical methods. This study helps faculty members and other university personnel who work with either Mexican or Chinese students to better understand and improve their mental health status. © The Editor(s) (if applicable) and The Author(s), under exclusive license to Springer Nature Switzerland AG 2020.

Rivero-Orozco, B., Rossa-Sierra, A., & Cortés-Chávez, F. (2020). Mental health in different college education systems. In Nazir S., Ahram T., Karwowski W. (eds.), *Advances in Human Factors in Training, Education, and Learning Sciences. AHFE 2020. Advances in Intelligent Systems and Computing*, vol 1211 (pp. 175-181). Cham, Switzerland: Springer. doi: 10.1007/978-3-030-50896-8_27. Book Chapter.

Fabiola Cortés Chávez

Profesor investigador

NEW BIRTHING BED DESIGN THAT IMPROVES USER EXPERIENCE DURING DELIVERY PHASE, INCLUDING ERGONOMIC FACTORS

ABSTRACT. The design process for a birthing bed in search of incrementing the satisfaction of every user involved during delivery. Our design proposal seeks adequate participation of them during the delivery. The users considered in this study are the mother, the companion, the gynecologist/obstetrician, the pediatrician, the anesthesiologist, the birth nurses, and the maintenance personnel. The design proposal was determined based on the following aspects: increasing comfort, safety, emotional state and effectiveness in the delivery process. © 2021, The Editor(s) (if applicable) and The Author(s), under exclusive license to Springer Nature Switzerland AG.

Villalpando-Chávez, N., Vázquez-Hernández, C., Escoto-Aceves, M. A., Cortés-Chávez, F., & Raymundo-Garnier-Ortiz, C. (2021). New Birthing Bed Design that Improves User Experience During Delivery Phase, Including Ergonomic Factors. In Karwowski, W., Ahram, T., Etinger, D., Tanković, N., Taiar, R. (eds.), *Human Systems Engineering and Design III. IHSED 2020. Advances in Intelligent Systems and Computing*, vol 1269 (pp. 186-191). Cham, Switzerland: Springer. doi: 10.1007/978-3-030-58282-1_30. Book Chapter.

María Luisa Cruz López

Profesor investigador

ANALYSIS OF RANDOM-PHASE DISTRIBUTIONS AND PERLIN NOISE IN CGH: A STUDY OF ITS EFFECTS ON FOURIER AND FRESNEL HOLOGRAMS RECONSTRUCTION

ABSTRACT. In computer-generated holograms (CGH), a random phase (RP) is usually introduced to spread the object information in the hologram and avoid the frequency-filtering effect in the reconstructed image. However, this action introduces speckle noise in the reconstructed image but also permits one to reconstruct objects with bigger size than the hologram. In recent years, alternative RPs have been proposed to reduce the speckle noise in comparison with the uniform distributed RP that is usually applied. However, its effects in different types of holograms, its capacity to reconstruct big objects, and its capability to eliminate the frequency-filtering effect have not been reviewed in detail. We present an analysis of the normal distributed, pink, brown, and Perlin phases in Fourier and Fresnel holograms coded as amplitude and phase (Kinoform and complex amplitude encoded). Only in the Kinoform holograms, the RP is required to eliminate the frequency-filtering effect. In other cases, the

phase is useful to record big objects in the hologram. The Perlin phase had a better performance than the other phases, achieving the reconstruction of objects with bigger size than the hologram and reducing the speckle noise. We present a quantitative and qualitative analysis of each distribution, including simulated and experimental results that confirm the numerical analysis. We believe these results could be helpful in the selection of an adequate RP in CGH, according to the hologram configuration. © 2020 Society of Photo-Optical Instrumentation Engineers (SPIE).

Cruz, M. L. & González-Velázquez, K. G. (2020). Analysis of random-phase distributions and Perlin noise in CGH: a study of its effects on Fourier and Fresnel holograms reconstruction. *Optical Engineering*, 59(10). doi: 10.1117/1.OE.59.10.102419. Article.

María Luisa Cruz López

Profesor investigador

INCREASING RECONSTRUCTED IMAGE QUALITY USING A RANDOM-REPEATED AND DISPLACED PHASE IN TIME-AVERAGE COMPUTER-GENERATED HOLOGRAMS

ABSTRACT. We use a random-repeated and displaced phase in time-average holograms to reduce the speckle noise in the reconstructed image and keep the object information dispersion in the hologram. We found that for less of 20 holograms the new phase has better performance than the random phase. © OSA 2019 © 2019 The Author(s).

Cruz, M. L., & Domínguez-Hernández, N. L. (2019). Increasing reconstructed image quality using a random-repeated and displaced phase in time-average computer-generated holograms. *Digital Holography and Three-Dimensional Imaging 2019* (France), Bordeaux. doi: 10.1364/DH.2019.W3A.33. Conference Paper.

Héctor Gabriel Dávalos Alejo

SNI Nivel C

A GROUND MOTION PREDICTION EQUATION FOR FILTERED INCREMENTAL VELOCITY, FIV₃

ABSTRACT. Filtered incremental velocity, FIV₃, is a recently proposed and very promising intensity measure for seismic collapse risk assessment. However, no ground motion prediction equation currently exists that enables its complete implementation in probabilistic seismic hazard analysis or in seismic performance assessment of structures. This paper presents a model for the estimation of the random horizontal component of FIV₃ for stiff soil sites, moment magnitudes between 5 and 8, and Joyner-Boore distances between 0 and 150 km. Results from this study show that the uncertainty

in the estimation of FIV₃ is considerably lower than the one provided by current models for pseudo-acceleration spectral ordinates. This low dispersion of FIV₃ results in a reduction in the uncertainty in the ordinates of seismic hazard curves, which ultimately improves the reliability of the estimation of the collapse risk of structures. © 2020 Elsevier Ltd.

Dávalos, H., Heresi, P., & Miranda, E. (2020). A ground motion prediction equation for filtered incremental velocity, FIV₃. *Soil Dynamics and Earthquake Engineering*, 139. doi: 10.1016/j.soildyn.2020.106346. Article.

Héctor Gabriel Dávalos Alejo

SNI Nivel C

EVALUATION OF FIV₃ AS AN INTENSITY MEASURE FOR COLLAPSE ESTIMATION OF MOMENT-RESISTING FRAME BUILDINGS

ABSTRACT. Seismic collapse estimations strongly depend on selecting an intensity measure that minimizes the dispersion in collapse capacities and any possible bias. This study evaluates the recently proposed Filtered Incremental Velocity (FIV₃) intensity measure for estimating collapse intensities of moment-resisting-frame buildings and compares its performance with two traditional intensity measures, namely spectral acceleration at the first-mode period of the structure and spectral acceleration combined with an explicit consideration of the spectral shape proxy ϵ , and with two advanced intensity measures, namely Saavg and IMcomb. Comparisons are made using collapse results from six special moment frame buildings having 1 to 20 stories. It is shown that for buildings with periods of vibration shorter than 1 s, FIV₃ provides the best overall results based on efficiency and sufficiency with respect to magnitude, distance, spectral shape, duration, and scale factor. For buildings with periods longer than 1 s, FIV₃ is comparable to Saavg and IMcomb, and clearly outperforms Sa and Sa+ ϵ . Based on these results, a generalization of FIV₃ is proposed as an intensity measure for the seismic collapse estimation of moment frame buildings. © 2020 American Society of Civil Engineers.

Dávalos, H. & Miranda, E. (2020). Evaluation of FIV₃ as an Intensity Measure for Collapse Estimation of Moment-Resisting Frame Buildings. *Journal of Structural Engineering (United States)*, 146(10). doi: 10.1061/(ASCE)ST.1943-541X.0002781. Article.

Fernando Dávalos Hernández

Profesor investigador

José Sebastián Gutiérrez Calderón

Investigador Titular D, SNI Nivel I

IMPROVEMENTS ON SIGNAL-TO-NOISE RATIO IN FEEDBACK MEASUREMENT IN DC/DC CONVERTERS

ABSTRACT. This paper presents different techniques for sensing the feedback signals of isolated DC/DC converters. The paper compares the traditional measuring chain with two other options that improve the signal-to-noise (SNR) significantly. A theoretical analysis and experimental tests are presented. The results indicate that, with this SNR improvement.

Hernández, F. D., Ibáñez, F., Gutiérrez, S., & Martínez, W. (2020). Improvements on signal-to-noise ratio in feedback measurement in DC/DC converters. 2020 IEEE. 22nd European Conference on Power Electronics and Applications (EPE'2020 ECCE Europe) (France), Lyon. doi: 10.23919/EPE20ECCEurope43536.2020.9215774. Conference Paper.

Lorenzo Miguel Elguea Fernández

Profesor investigador

Félix Orlando Martínez Ríos

Investigador Titular C, SNI Nivel I

NEW METRICS TO MODIFY BGP ROUTES BASED ON SDN

ABSTRACT. Through Software Defined Network, routes obtained through Border Gateway Protocol can be modified to improve latency or select a shorter path. With the same tool that perform the above actions, you can modify routes, for example, to avoid autonomous systems in certain countries or some other policy that may help, for example, security. © 2019, Springer Science+Business Media, LLC, part of Springer Nature.

Elguea, L. M. & Martínez-Ríos, F. (2020). New metrics to modify BGP routes based on SDN. *Wireless Networks*, 26(8), 5623-5630. doi: 10.1007/s11276-019-02025-3. Article.

Ricardo Abel Espinosa Loera

Profesor investigador

José Sebastián Gutiérrez Calderón

Investigador Titular D, SNI Nivel I

Hiram Eredín Ponce Espinosa

Investigador Titular D, SNI Nivel I

CLICK EVENT SOUND DETECTION USING MACHINE LEARNING IN AUTOMOTIVE INDUSTRY

ABSTRACT. Artificial intelligence has been playing an important role when it comes to the automotive industry and its quality of assemblies in the production line, this is because since the arrival of the industry 4.0 it has been subject to change and continuous improvement. In the past, we've observed how many machine learning architectures have been used to create environmental sound classification systems in order to improve traditional systems, thus overcoming efficiency issues with great results. In this work, we present a machine learning solution/approach for click event sound detection using audio sensors that are used in the assembly of electric harnesses for engines, this being done on an automotive production line, where we divided our workflow into: data collection, pre-processing, feature extraction, training and inference and finally the detection of the click event sounds. We created a dataset that is composed by 25,000 audio files that have an average duration of 0.025 seconds per click sound with the purpose of training a Multi-layer Perceptron and bring it into the inference phase. In order to test this approach, we've performed various implementations in a laboratory and in the real automotive industry. We obtained 95.23% in F1-Score Metric in a laboratory, while in real conditions, we obtained less reliable results, as 84.00% as the best results. © 2020, Springer Nature Switzerland AG.

Espinosa, R., Ponce, H., Gutiérrez, S., & Hernández E. (2020). Click Event Sound Detection Using Machine Learning in Automotive Industry. In Martínez-Villaseñor, L., Herrera-Alcántara, O., Ponce, H., Castro-Espinosa, F.A. (eds.), *Advances in Soft Computing. 19th Mexican International Conference on Artificial Intelligence, MICAI 2020. Lecture Notes in Computer Science*, vol 12468 (pp. 88-103). Cham, Switzerland: Springer. doi: 10.1007/978-3-030-60884-2_7. Book Chapter.

Ricardo Abel Espinosa Loera

Profesor investigador

José Sebastián Gutiérrez Calderón

Investigador Titular D, SNI Nivel I

DESIGN AND IMPLEMENTATION OF A NODE GEOLOCATION SYSTEM FOR FIRE MONITORING THROUGH LORAWAN

ABSTRACT. Maturity of LoRAWAN based solutions has led to the integration of innovative services in IoT systems, being geolocation a remarkable feature that enables functionalities as asset tracking. The before mentioned capability, combined with Real-Time responsiveness and data analysis could derive to the possibility of smarter systems that significantly add value to applied technology. The current work contains the implementation of a technique for geolocation based on LoRaWAN which has been integrated into an IoT end to end (e2e) solution that monitors the probability of an existing fire. By adding this characteristic, the system can locate a fire incident at the right moment and prevent material, economic and environmental affectations. © 2020 IEEE.

Luna P, Gutierrez S., & Espinosa R. (2020). Design and Implementation of a Node Geolocation System for Fire Monitoring through LoRaWAN. 2020 IEEE. 2020 IEEE International Autumn Meeting on Power, Electronics and Computing (ROPEC) (Mexico), Ixtapa. doi: 10.1109/ROPEC50909.2020.9258741. Conference Paper.

Ricardo Abel Espinosa Loera

Profesor investigador

José Sebastián Gutiérrez Calderón

Investigador Titular D, SNI Nivel I

Jorge Varona Salazar

SNI Nivel I

SMART MOBILE LORA AGRICULTURE SYSTEM BASED ON INTERNET OF THINGS

ABSTRACT. Agriculture represents the main source of food in the world, but it also represents challenges such as population growth, urbanization and aging, global economic growth, investment, trade, and food prices and competition for natural resources. The development of technology can help us cope with these challenges. The internet of things (IoT) technology represents the future of computing and communications. These can be useful to improve traditional agriculture methods around the world. By implementing these modern technologies is possible to reduce costs and maintenance and, to increase the performance of our

agriculture processes and goods. Particularly, one of this relatively new technology is the LoRa communication protocol that uses long wavelengths for the communication link to obtain long ranges. This is extremely useful in agriculture where the communicating areas are extensive crop fields and greenhouses. This paper proposes and presents the development of a mobile LoRaWAN gateway device that can be applied to increase greenhouses' productivity and accuracy. The presented development includes the use of a Heltec's Mini LoRa Gateway controlled by a Raspberry Pi 3 B+. It is powered by an external Li-On battery and uses a defined number of LoRa nodes with sensors. Sensors will measure humidity and temperature and send the data, which are gathered by the mobile LoRaWAN gateway. These data are processed using third-party free online services. This document illustrates and explains the development and application of data collectors for agriculture and their advantages. © 2019 IEEE.

Gutiérrez, S., Martínez, I., Varona, J., Cardona, M., & Espinosa, R. (2019). Smart Mobile LoRa Agriculture System based on Internet of Things. 2019 IEEE. 2019 IEEE 39th Central America and Panama Convention (CONCAPAN XXXIX) (Guatemala), Guatemala City. doi: 10.1109/CONCAPANXXXIX47272.2019.8977109. Conference Paper.

David García Peláez Cruz

Profesor investigador

THE GEOMETRY OF INDUCED ELECTROMAGNETIC FIELDS IN MOVING MEDIA

ABSTRACT. In this manuscript we provide a fully geometric formulation for the induced electromagnetic fields and their corresponding constitutive relations in moving media. To this end, we present the reader with a brief geometric summary to show how vector calculus electromagnetic theory is embedded in the more general language of differential forms. Then, we consider the class of metric constitutive relations describing the medium in which electromagnetic fields propagate. We explicitly obtain the components of the induced fields in a moving medium, as seen in the lab rest frame. This allows us to read the expressions for the permittivity, permeability and magnetoelectric matrices for the moving medium which, in turn, can be interpreted as a different physical material from the lab point of view. © 2020 Elsevier Inc.

López-Monsalvo, C. S., García-Peláez, D., Rubio-Ponce, A., & Escarela-Perez, R. (2020). The geometry of induced electromagnetic fields in moving media. *Annals of Physics*, 420. doi: 10.1016/j.aop.2020.168270. Article.

Héctor Eduardo Gilardi Velázquez

SNI Nivel C

A PHYSICAL INTERPRETATION OF FRACTIONAL-ORDER-DERIVATIVES IN A JERK SYSTEM: ELECTRONIC APPROACH

ABSTRACT. In this paper, a physical interpretation of the fractional-order-derivatives effects in a jerk system, based on Unstable Dissipative Systems (UDS), and a Saturated Non-Linear Function (SNLF), is presented. The system is electronically implemented in Multisim development platform for a 9-scrolls attractor generation. The behavior is analyzed through the Detrended Fluctuation Analysis (DFA), Probability Density Function (PDF), bifurcation diagrams, and the implementation of a geometrical analysis of the phase space. The changes that the system undergoes when a fractional-order are analyzed. The results show that when the fractional integration-orders are considered, the areas of the generated attractor are modified with respect to the integer-order dynamic. The long-range correlations in the system are also modified because of the fractional-orders. Besides, a particular phenomenon in the equilibrium points preference occurs, which is induced when the fractional integration-order is applied in only one of the state variables. © 2020 Elsevier B.V.

Echenausía-Monroy, J. L., Gilardi-Velázquez, H. E., Jaimes-Reátegui, R., Aboites, V., & Huerta-Cuellar, G. (2020). A physical interpretation of fractional-order-derivatives in a jerk system: Electronic approach. *Communications in Nonlinear Science and Numerical Simulation*, 90. doi: 10.1016/j.cnsns.2020.105413. Article.

Héctor Eduardo Gilardi Velázquez

SNI Nivel C

EMERGENCE OF A SQUARE CHAOTIC ATTRACTOR THROUGH THE COLLISION OF HETEROCLINIC ORBITS

ABSTRACT. In this work we introduce a square chaotic attractor based on the collision of two heteroclinic orbits. Before the collision, the system presents the coexistence of two double scroll attractors that are generated via piecewise linear (PWL) systems that deal with two saddle-foci equilibria of different classes, i.e. the dimensions of the unstable and stable manifolds of one of the equilibrium points are one and two, respectively, and vice versa for the unstable and stable manifolds associated with the second equilibrium point. The new class is constructed based on the existence of a heteroclinic loop by linear affine systems with two saddle-focus equilibrium points of different types. The chaotic behavior of the proposed system is tested by the maximum Lyapunov exponent and the 0–1

chaos test. This new class of PWL dynamical systems exhibits different behaviors and allows the generation of different basins of attraction for the coexistence of two or more attractors. Therefore, a mechanism to establish bistability is provided and how it can be controlled (i.e. bistability annihilation) via varying system's parameters is demonstrated.

Gilardi-Velázquez, H. E., Escalante-González, R. J., & Campos, E. (2020). Emergence of a square chaotic attractor through the collision of heteroclinic orbits. *The European Physical Journal Special Topics*, 229, 1351-1360. doi: 10.1140/epjst/e2020-900219-4. Article.

Héctor Eduardo Gilardi Velázquez

SNI Nivel C

INTERMITTENCY INDUCED IN A BISTABLE MULTISCROLL ATTRACTOR BY MEANS OF STOCHASTIC MODULATION

ABSTRACT. In this work, numerical results of a nonlinear switching system that presents bistable attractors subjected to stochastic modulation are shown. The system exhibits a dynamical modification of the bistable attractor, giving rise to an intermittent behavior, which depends of modulation strength. The resulting attractor converge to an intermittent double-scroll, for low amplitude modulation, and a 9-scroll attractor for a higher applied noise amplitude. A Detrended Fluctuation Analysis (DFA) applied to the x state variable, shows a perturbations robustness region, since the increase of noise does not present changes. Due to the applied noise, the final obtained system has higher randomness, compared with the original one. The understanding of the dynamical behavior of multiscrolls systems is highly important for advancing technology in communications, as well in memory systems applications. © 2019, Institute for Problems in Mechanical Engineering, Russian Academy of Sciences. All rights reserved.

Echenausía-Monroy, J. L., Huerta-Cuellar, G., Jaimes-Reátegui, R., García-López, J. H., & Gilardi-Velázquez, H. E. (2019). Intermittency induced in a bistable multiscroll attractor by means of stochastic modulation. *Cybernetics and Physics*, 8(3), 114-120. doi: 10.35470/2226-4116-2019-8-3-114-120. Article.

Héctor Eduardo Gilardi Velázquez

SNI Nivel C

MULTISTABILITY EMERGENCE THROUGH FRACTIONAL-ORDER-DERIVATIVES IN A PWL MULTI-SCROLL SYSTEM

ABSTRACT. In this paper, the emergence of multistable behavior through the use of fractional-order derivatives in a Piece-Wise Linear (PWL)

multi-scroll generator is presented. Using the integration order as a bifurcation parameter, the stability in the system is modified in such a form that produces a basin of attraction segmentation, creating many stable states as scrolls are generated in the integer-order system. The results here presented reproduce the same phenomenon reported in systems with integer-order derivatives, where the multistable regimen is obtained through a parameter variation. The multistable behavior reported is also validated through electronic simulation. The presented results are not only applicable in engineering fields, but they also enrich the analysis and the understanding of the implications of using fractional integration orders, boosting the development of further and better studies.

Echenaúsa-Monroy, J. L., Huerta-Cuellar, G., Jaimes-Reátegui, R., García-López, J. H., Aboites, V., Cassal-Quiroga, B. B., & Gilardi-Velázquez, H. E. (2020). Multistability emergence through fractional-order-derivatives in a PWL multi-scroll system. *Electronics (Switzerland)*, 9(6). doi: 10.3390/electronics9060880. Article.

Jesús Alberto GómezRomero Bórquez

Profesor investigador

Carolina del Valle Soto

Investigador Titular D, SNI Nivel I

ENGAGEMENT IN THE CINEMATOGRAPHY OF VIDEOGAMES: PROPOSAL OF AN ALGORITHM FOR COLORS AND FOCI OF ATTENTION ANALYSIS

ABSTRACT. This work compares two perspectives related to the production and imaging of a videogame called Shovel Knight, which was released in 2014. The purpose is to produce a greater impact on the user through the audiovisual production of the videogame. An analysis of attention foci and colors based on a perception algorithm are studied and compared for this videogame and two versions of it. We study the visual impact of videogames according to characteristics such as: color focuses, types of color with the intention of creating the videogame, player's emotional state in front of the images, and so on, obtaining a resembling to the reality of the software of 5%. Finally, as a case of study, we make a videogame done with real environment landscapes and characters and we contrast the same videogame made digitally in its original version. We obtained that the first version has a greater acceptance and enjoyment regarding the second one, with 95% of higher impact of attention for 35 people. This case analyzed the visual impact according to the criteria that videogames can generate in players. © The Editor(s) (if applicable) and The Author(s), under exclusive license to Springer Nature Switzerland AG 2020.

GomezRomero-Borquez, J. & Del-Valle-Soto, C. (2020). Engagement in the cinematography of videogames: Proposal of an algorithm for colors and foci of attention analysis. In Ahram T. & Falcão C. (eds.), *Advances in Usability, User Experience, Wearable and Assistive Technology. AHFE 2020. Advances in Intelligent Systems and Computing*, vol 1217 (pp. 627-633). Cham, Switzerland: Springer. doi: 10.1007/978-3-030-51828-8_82. Book Chapter.

José Sebastián Gutiérrez Calderón

Investigador Titular D, SNI Nivel I

AN IMPEDANCE BASED MODELING TOWARDS THE AGING PREDICTION OF LITHIUM-ION BATTERY FOR EV APPLICATIONS

ABSTRACT. Modeling of Lithium-Ion Battery (LIB) is essential for studying its behavior under different operating conditions like temperature, load current and state of charge. The parameters of a LIB such as capacity, open circuit voltage, impedance can be characterized by using a suitable model according to the application. This paper has proposed an impedance-based equivalent circuit modeling (ECM) approach for electric vehicles (EV) to estimate the aging of a LIB (LiFePO₄) and to prevent the system, where the battery is installed, from failure. The aging has been performed experimentally using a real electric motorcycle load profile and the impedance test results for the aged LIB at different cycles have been fitted and analyzed with a chosen ECM. In addition, the same ECM has been used to analyze and compare the aging for the same battery type with a profile achieved using a hybrid energy storage system (HESS) consisting of LIB and supercapacitors. The ECM for HESS profile showed smaller impedance change and smaller capacity reduction with aging compared with the ECM for the battery profile. Therefore, it validates that HESS has a longer cycle life than battery energy storage system. © 2019 IEEE.

Ibáñez, F. M., Ahmed, T., Idrisov, I., & Gutiérrez, J. S. (2019). An impedance based modeling towards the aging prediction of lithium-ion battery for EV applications. 2019 IEEE. 2019 8th International Conference on Renewable Energy Research and Applications (ICRERA) (Romania), Brasov (pp. 146-151). doi: 10.1109/ICRERA47325.2019.8996568. Conference Paper.

José Sebastián Gutiérrez Calderón

Investigador Titular D, SNI Nivel I

DEVELOPMENT AND TESTING OF A SINGLE-AXIS PHOTOVOLTAIC SUN TRACKER THROUGH THE INTERNET OF THINGS

ABSTRACT. Solar tracking systems enable increased efficiency of a photovoltaic system through a con-

tinuous adjustment of its position with respect to the sun, thus increasing the generation of electrical energy. The integration of photovoltaic solar tracking systems in buildings and houses enables the energy needs of users in a broader way to be covered. This integration is facilitated through the existence of technologies such as access to the Internet through Wi-Fi, which allows developing systems to be encompassed within the domain of the "Internet of Things" (IoT). In this study, a first-of-its-kind "open-loop" solar tracker was designed and developed, which executes the tracking algorithm in the Firebase web service and allows the exchange of data with said service through a NodeMCU development board, which has an integrated Wi-Fi module. After an experimental campaign in Aguascalientes, central Mexico, gains in terms of collected energy on average were measured at 29.9% in May compared to an optimally tilted fixed photovoltaic system. This study opens the possibility of integrating power generation systems into the IoT domain, which, among other things, allows for constant monitoring of the behavior of the system. © 2020 by the authors. Licensee MDPI, Basel, Switzerland.

Gutiérrez, S., Rodrigo, P. M., Álvarez, J., Acero, A., & Montoya, A. (2020). Development and testing of a single-axis photovoltaic sun tracker through the internet of things. *Energies*, 13(10). doi: 10.3390/en13102547. Article.

José Sebastián Gutiérrez Calderón

Investigador Titular D, SNI Nivel I

Hiram Eredín Ponce Espinosa

Investigador Titular D, SNI Nivel I

DEVELOPMENT OF HEN EGGS SMART INCUBATOR FOR HATCHING SYSTEM BASED ON INTERNET OF THINGS

ABSTRACT. For hen breeders, hatching eggs in large quantities is a production problem, when they are incubated by hens. This paper describes the development of an intelligent system for a hen egg incubator. This incubation system, based on Arduino, LabVIEW, Google Firebase and MIT App Inventor can control temperature, humidity and egg rotation automatically. In addition, the system can help farmers to monitor the intelligent incubator remotely. Successful hatched hen eggs are typically around 87.55%, 0.41 % hatched defectively, 1.84% hatched but die at birth, and 10.20 % not hatched, so an intelligent temperature and humidity control system can improve the successful hatching rate. The objective of this system is not to offer it for sale, but to make it available for researchers and farmers so that they can replicate it and carry out experiments. In order to do this, the system was kept as simple as possible. © 2019 IEEE.

Gutiérrez, S., Contreras, G., Ponce, H., Cardona, M., Amadi, H., & Enríquez-Zarate, J. (2019). Development of Hen Eggs Smart Incubator for Hatching System Based on Internet of Things. 2019 IEEE. 2019 IEEE 39th Central America and Panama Convention (CONCAPAN XXX-IX) (Guatemala), Guatemala City. doi: 10.1109/CONCAPANXXXIX47272.2019.8976987. Conference Paper.

José Sebastián Gutiérrez Calderón

Investigador Titular D, SNI Nivel I

INTERNET OF THINGS: LOW COST MONITORING BEEHIVE SYSTEM USING WIRELESS SENSOR NETWORK

ABSTRACT. Precision Beekeeping is an emerging research direction of Internet Things, based on a management strategy of individual monitoring of the colonies to minimize consumption resources and maximize the productivity of bee, is a challenging topic in the conditions of helping to add value to the apicultural chain, preserve the species, take care of the environment and contribute to the economic and social development of the territory. This document proposes an IoT system that can be applied into the hive to help beekeepers to get better control through precision measurements. The need and importance of how this system can collaborate to carry out more in-depth studies in the region through precision beekeeping are presented too. Therefore this document proposes a system architecture that can help to increase the productivity and accuracy using sensors to measure humidity, temperature, and weight remotely to finally send this data from the hive to the third-party online Ubidots platform services. © 2019 IEEE.

Ochoa, I. Z., Gutiérrez, S., & Rodríguez, F. (2019). Internet of things: Low cost monitoring beehive system using wireless sensor network. 2019 IEEE. 2019 IEEE International Conference on Engineering Veracruz (ICEV) (Mexico), Xalapa. doi: 10.1109/ICEV.2019.8920622. Conference Paper.

José Sebastián Gutiérrez Calderón

Investigador Titular D, SNI Nivel I

LOW COST CO DETECTOR INTEGRATED WITH IOT

ABSTRACT. This article presents a low cost project focused on detecting carbon monoxide in the environment and warning the user, based on the usage of the MQ-7 sensor, a loudspeaker (active buzzer) and the integrated circuit ESP8266. By means of the mobile application Blynk, the prototype will display the carbon monoxide levels in the environment in real time on your mobile device. If the concentration of carbon monoxide exceed 25 particles per million a

loudspeaker will ring and send an alert to the mobile device instructing the people to leave the room, because this level of carbon monoxide concentration can be harmful or lethal to human health. The objective is to monitor the areas where it is possible a harmful concentration of carbon monoxide and ensure that people can leave in time before their health is in danger. © 2019 IEEE.

Estrada, E., Moreno, M., Martin, K., Mever, A.L., Rodrigo, P. M., & Gutiérrez, S. (2019). Low cost CO detector integrated with IoT. *2019 IEEE. 2019 IEEE International Conference on Engineering Veracruz (ICEV) (Mexico), Xalapa*. doi: 10.1109/ICEV.2019.8920567. Conference Paper.

José Sebastián Gutiérrez Calderón

Investigador Titular D, SNI Nivel I

LOW COST GREENHOUSE MONITORING SYSTEM BASED ON INTERNET OF THINGS

ABSTRACT. It is a well-known situation that nowadays people are opting for organic food grown in an ecological way to reduce carbon footprint and damage to the environment. Ecology is suffering because of the use of pesticides and crop protection chemicals due to the damage caused to the flora and fauna in the environment where the crops are being cultivated. Combined with this, people are trying to get the freshest vegetables, fruits, and even flowers. Because of these situations, it is more common nowadays to find people trying to grow their food, or plants that they can't get in the place they live. For this, it is useful to use tools that can help the growth of these plants and make the job easier, but usually, greenhouses controllers are expensive and unnecessary due to the size of the home plantations. The creation of a low-cost greenhouse prototype that can be used in houses or small farms to help the people grow their crops and its comparison with current commercial systems are presented. © 2019 IEEE.

Lara, J. C. D., Gutierrez, S., & Rodriguez, F. (2019). Low cost greenhouse monitoring system based on internet of things. *2019 IEEE. 2019 IEEE International Conference on Engineering Veracruz (ICEV) (Mexico), Xalapa*. doi: 10.1109/ICEV.2019.8920502. Conference Paper.

José Sebastián Gutiérrez Calderón

Investigador Titular D, SNI Nivel I

MOBILE POSITIONING FOR IOT-BASED BUS LOCATION SYSTEM USING LORAWAN

ABSTRACT. This article aims to describe, explain and propose the implementation of a Mobile LoRaWAN Gateway device and how this can use the benefits of the LoRaWAN communication protocol and system architecture along with IoT to bring a new

solution for applications which need a mobile alternative, or which not have the resources to support a conventional LoRaWAN gateway solution. The purpose of this project is to test the capabilities of the LoRaWANTaking a different approach and prove its advantages against other similar solutions that do not use LoRaWANfor some applications. © 2019 IEEE.

Duron, J. I. M., Gutiérrez, S., & Rodríguez, F. (2019). Mobile positioning for IoT-based bus location system using LoRaWAN. *2019 IEEE. 2019 IEEE International Conference on Engineering Veracruz (ICEV) (Mexico), Xalapa*. doi: 10.1109/ICEV.2019.8920542. Conference Paper.

José Sebastián Gutiérrez Calderón

Investigador Titular D, SNI Nivel I

OPTIMUM CLEANING SCHEDULE OF PHOTOVOLTAIC SYSTEMS BASED ON LEVELISED COST OF ENERGY AND CASE STUDY IN CENTRAL MEXICO

ABSTRACT. In this paper, the soiling impact on photovoltaic systems in Aguascalientes, in central Mexico, an area where 1.4GWp of new photovoltaic capacity is being installed, is characterised experimentally. A soiling rate of -0.16%/day in the dry season for optimally tilted crystalline silicon modules, and a stabilization of the soiling losses at 11.2% after 70 days of exposure were observed. With these data, a first of its kind novel method for determining optimum cleaning schedules is proposed based on minimising the levelised cost of energy. The method has the advantages compared to other existing methods of considering the system investment cost in the determination of the optimum cleaning schedule. Also, it does not depend on economic revenue data, which are often subject to uncertainty. The results show that residential and commercial systems should be cleaned once per year in Aguascalientes. On the other hand, cleaning intervals from 12 to 31 days in the dry season were estimated for utility-scale systems, due to the dramatic decrease of cleaning costs per unit photovoltaic capacity. We also present a comparative analysis of the existing criteria for optimising cleaning schedules applied to the same case study. The different methods give similar cleaning intervals for utility-scale systems and, thus, the choice of a suitable method depends on the availability of information. © 2020 International Solar Energy Society.

Rodrigo, P. M., Gutiérrez, S., Micheli, L., Fernández, E. F., & Almonacid, F. M. (2020). Optimum cleaning schedule of photovoltaic systems based on levelised cost of energy and case study in central Mexico. *Solar Energy*, 209, 11-20. doi: 10.1016/j.solener.2020.08.074. Article.

José Sebastián Gutiérrez Calderón

Investigador Titular D, SNI Nivel I

WIRELESS AMMETER BASED ON ZIGBEE FOR CONTINUOUS MONITORING OF INDUCTION MOTORS

ABSTRACT. The Internet of Things (IoT) has shown the ability to exploit the potential of data, transforming objects of everyday life essentially into computers, by equipping them with sensors capable of measuring physical variables of the environment that surrounds them, and equipped with standards and communication protocols, acquire the ability to build an ecosystem of identifiable objects in a unique way, which generate data automatically, and with the possibility of responding to stimulus from the same environment, in a few words generate automatic responses to well defined situations. These characteristics promise great benefits to the industrial sector making reality the fourth industrial revolution better known as Industry 4.0, whose fundamental pillar is the Industrial Internet of Things (IIoT). The objective of this work is to apply the Industry 4.0 technologies for the benefit of industrial maintenance by developing a measuring instrument using open source tools with the purpose to be a support for decision-making related to machinery maintenance. Specifically, the instrument to be developed fulfills the functions of an ammeter, which is an instrument of wide industrial use. The ammeter presented has integrated ZigBee technology that allows creating Wireless Sensor Network for remotely measure the electrical current consumption of the machinery to be monitored. Because induction motors are one of the most important assets within the industry, the proposed development is intended to be a support tool for the Condition-based maintenance approach to identify on time when the motors in a manufacturing process works abnormally and thus help to prevent critical failures.

Gutiérrez, S., Islas, L., Ibáñez, F. M., Cardona, M., Calzada, J., & Solanki, V. K. (2019). Wireless Ammeter Based on ZigBee for Continuous Monitoring of Induction Motors. 2019 IEEE. 2019 IEEE 39th Central America and Panama Convention (CONCAPAN XXXIX) (Guatemala), Guatemala City. doi: 10.1109/CONCAPANXXXIX47272.2019.8977048. Conference Paper.

José Sebastián Gutiérrez Calderón

Investigador Titular D, SNI Nivel I

WIRELESS SENSOR NETWORK PROTOTYPE TO MONITOR THE CONDITION OF HOLDING FURNACES IN THE ALUMINUM CASTING PLANT

ABSTRACT. Currently in the industry, higher production levels are required every day, for this reason, it is essential that the machinery used for production is always in optimal conditions which will consequently increase the production efficiency. Due to this, the continuous monitoring of the machinery's condition has become a strong strategy to maximize production time. Due to the growing demand to monitor technologies, this document proposes the development of a prototype that allows monitoring the condition of maintenance furnaces used in a foundry plant to keep melted aluminum at a temperature between 600°C and 620°C. The electrical current consumed by the resistors that maintain the temperature in melted aluminum is measured through a Wireless Sensors Network (WSN). Through this network, it is possible to monitor this type of machinery continuously and remotely, allowing awareness of the industry's wellbeing thanks to the application of the Industrial Internet of Things. © 2019 IEEE.

Islas, L., Gutiérrez, S., & Rodríguez, F. (2019). Wireless sensor network prototype to monitor the condition of holding furnaces in the aluminum casting plant. 2019 IEEE. 2019 IEEE International Conference on Engineering Veracruz (ICEV) (Mexico), Xalapa. doi: 10.1109/ICEV.2019.8920457. Conference Paper.

José Sebastián Gutiérrez Calderón

Investigador Titular D, SNI Nivel I

Hiram Eredín Ponce Espinosa

Investigador Titular D, SNI Nivel I

WIRELESS TEMPERATURE MONITORING SYSTEM THROUGH IOT FOR DOMESTIC SOLAR WATER HEATERS

ABSTRACT. The popularization of solar water heaters in many houses makes it necessary to create an electronic tool for monitoring water temperature as a function of time. It should be easy to use and cost effective so most of the users can get it. This article presents the analysis of the problem, the design proposal, prototyping and test results of the development of a wireless temperature monitoring system in a domestic water heater tank. This device allows knowing the temperature of the heater in real time by using IoT (Internet of Things) technology. It uses the device's internal memory where machine learning algorithms customize settings that can trigger intelligent alarms such as water leak detec-

tion, under or over temperature, and efficiency loss. The device delivers the data to the user or to other devices (for further automation) by local Wi-Fi. The scalable architecture of IoT allows adding extra measurements for physical phenomena that affect the heater's performance, such as water flow, sun radiation and outdoor relative humidity. Those measurements can be easily integrated in a more complex system version for commercial or industrial customers. © 2019 IEEE.

Cardona, M., Romo, V. H., Gutiérrez, S., Rodrigo, P. M., Ponce, H., & Kumar, R. (2019). Wireless Temperature Monitoring System through IoT for Domestic Solar Water Heaters. 2019 IEEE. 2019 IEEE 39th Central America and Panama Convention (CONCAPAN XXX-IX) (Guatemala), Guatemala City. doi: 10.1109/CONCAPANXXXIX47272.2019.8977014. Conference Paper.

Carlos Eduardo López Hernández

Investigador Titular B, SNI Nivel I

Samuel Moisés Nucamendi Guillén

SNI Nivel C

A CLUSTERING ALGORITHM FOR IPSATIVE VARIABLES

[ALGORITMO DE CLUSTERIZACIÓN PARA VARIABLES IPSATIVAS]

ABSTRACT. The aim of this study is to introduce a new clustering method for ipsative variables. This method can be used for nominal or ordinal variables for which responses must be mutually exclusive, and it is independent of data distribution. The proposed method is applied to outline motivational profiles for individuals based on a declared preferences set. A case study is used to analyze the performance of the proposed algorithm by comparing proposed method results versus the PAM method. Results show that the proposed method generates a better segmentation and differentiated groups. An extensive study was conducted to validate the performance clustering method against a set of random groups by clustering measures.

Rubiano-Moreno, J., Alonso-Malaver, C., Nucamendi-Guillén, S., & López-Hernández, C. (2019). A clustering algorithm for ipsative variables [Algoritmo de clusterización para variables ipsativas]. *DYNA (Colombia)*, 86(211), 94-101. doi: 10.15446/dyna.v86n211.77835. Article.

Ricardo Macías Quijas

Profesor investigador

Ramiro Velázquez Guerrero

SNI Nivel I

DEVELOPMENT OF AN ELECTRONIC NOSE DEVICE FOR SECURITY APPLICATIONS

ABSTRACT. This paper presents a low-cost electronic nose (enose) device for detecting environmental gases that might be threatening for the human health such as combustible gas, alcohol, methane, carbon monoxide, hydrogen, among others. The prototype consists of a six-sensor array deployed in a compact structure. Sensors were characterized and a data acquisition system was implemented to visualize the sensors behavior. Preliminary experimental results show that the device is functional and that the sensors readings are suitable for a later classification stage. The proposed device might find applications in mobile robots, public transportation, and sensor arrays for monitoring toxic emissions. © 2019 IEEE.

Macías-Quijas, R., Geil, A., Velázquez, R., & Lay-Ekuakille, A. (2019). Development of an Electronic Nose Device for Security Applications. 2019 IEEE. 2019 IEEE 39th Central America and Panama Convention (CONCAPAN XXXIX) (Guatemala), Guatemala City. doi: 10.1109/CONCAPANXXXIX47272.2019.8976974. Conference Paper.

José Antonio Marmolejo Saucedo

SNI Nivel II

A NEW ALGORITHM FOR OPTIMIZATION OF QUALITY OF SERVICE IN PEER TO PEER WIRELESS MESH NETWORKS

ABSTRACT. Nowadays, wireless mesh networks are known as important parts of different commercial, scientific, and industrial processes. Their prevalence increases day-by-day and the future of the world is associated with such technologies for better communication. However, the issue of improving quality of service for dealing with more complex and intense flow of data has been always a remarkable research problem, as a result of improved wireless communication systems. In this sense, objective of this study is to provide a new algorithm for contributing to the associated literature. In the study, peer to peer wireless mesh networks and the concept of service quality were examined first and then an approach for improving service quality in such networks has been proposed accordingly. In detail, the proposed approach allows profiting data transfer capability by data packet and using this information for routing and preventing overcrowd in network nodes and finally, distributing the load over it. When middle nodes overcrowd, they withhold to send control

messages of route creating or do that by delay. The proposed approach has been evaluated and the findings revealed that at least 10% of undue delays through network can be prevented while permissivity does not reduce, thanks to the approach. Also energy consumption within network nodes partially increases due to adding table and the search which can be overlooked. © 2019, Springer Science+Business Media, LLC, part of Springer Nature.

Gheisari M., Alzubi J., Zhang X., Kose U., & Saucedo J. A. M. (2020). A new algorithm for optimization of quality of service in peer to peer wireless mesh networks. *Wireless Networks*, 26(7), 4965-4973. doi: 10.1007/s11276-019-01982-z. Article.

José Antonio Marmolejo Saucedo

SNI Nivel II

Román Rodríguez Aguilar

SNI Nivel II

A PROPOSAL FOR THE SUPPLY CHAIN DESIGN: A DIGITIZATION APPROACH

ABSTRACT. The logistics network of an automotive company in Mexico, was analyzed to propose a better logistics network in the country to improve delivery times to customers. The network design considers elements of digitization of Greenfield Analysis and Network Optimization processes. Taking into account the information given by the company, it was possible to obtain optimal scenarios for better operation, which involved the construction of distribution centers throughout Mexico. © 2020 Jose Antonio Marmolejo-Saucedo et al., licensed to EAI.

Marmolejo-Saucedo, J. A., Retana-Blanco, B., Rodríguez-Aguilar, R., & Pedraza-Arroyo, E. (2020). A proposal for the supply chain design: A digitization approach. *EAI Endorsed Transactions on Energy Web*, 7(29). doi: 10.4108/EAI.13-7-2018.164112. Article.

José Antonio Marmolejo Saucedo

SNI Nivel II

A ROBUST MULTISTAGE APPROACH TO SOLVE THE GENERATION AND TRANSMISSION EXPANSION PLANNING PROBLEM EMBEDDING RENEWABLE SOURCES

ABSTRACT. This paper proposes a robust multistage approach to solve the generation and transmission expansion planning problem, which is formulated by the three-level method. This one is transformed into a bi-level problem to appraise the solution to this problem by the Benders decomposition method, which is then compared with the column and constraint generation (C&CG) solution. Results and

computing times are analysed, assuming a limited budget in generation expansion and different generation capacity and demand. An illustrative example on the Mexican power system taking into account renewables sources enhances the effectiveness of the proposed approach. © 2020 Elsevier B.V.

Ramírez, J. M., Hernández, A., & Marmolejo, J. A. (2020). A robust multistage approach to solve the generation and transmission expansion planning problem embedding renewable sources. *Electric Power Systems Research*, 186. doi: 10.1016/j.epsr.2020.106396. Article.

José Antonio Marmolejo Saucedo

SNI Nivel II

AN EXTENDED ACCESS CONTROL MODEL FOR PERMISSIONED BLOCKCHAIN FRAMEWORKS

ABSTRACT. In distributed environment, a digital transaction or operation requires transparency and trust among multiple stakeholders. Several approaches address such issues however, among these blockchain provides a viable solution which has received wide acceptance in the recent past. Permissioned blockchain solutions adopt more efficient consensus algorithms and smart contracts. There are many smart-contract solutions exists (such as, ethereum, IBM blockchain, hyperledger fabric), however, much of them mainly follow traditional access control models. A role-based access control model provides controlled access of resources to members. This research work presents an extended usage control model known as DistU (Distributed Usage Control). DistU is proposed to capture all possible access control models required by a business for permissioned blockchain frameworks. DistU can monitor a resource continuously during the operation and update the attributes accordingly, performing different actions, such as denying or revoking permissions. We believe that the proposed DistU usage control model can provide a fine-grained control for blockchain resource management. The paper also contributes to provide a prototype implementation of fine-grained permission model on Hyperledger Fabric. The reason of selecting Fabric for this research is that, it is the first execute-order architecture blockchain that provides a platform to develop general business applications. Secondly, it is an opensource operating system of permissioned blockchain with huge industry support. © 2019, Springer Science+Business Media, LLC, part of Springer Nature.

Khan, M. Y., Zuhairi, M. F., Ali T., Alghamdi T., & Marmolejo-Saucedo J. A. (2020). An extended access control model for permissioned blockchain frameworks. *Wireless Networks*, 26(7), 4943-4954. doi: 10.1007/s11276-019-01968-x. Article.

José Antonio Marmolejo Saucedo

SNI Nivel II

AN OPTIMIZED COVERING SPHEROIDS BY SPHERES

ABSTRACT. Covering spheroids (ellipsoids of revolution) by different spheres is studied. The research is motivated by packing non-spherical particles arising in natural sciences, e.g., in powder technologies. The concept of an ε -cover is introduced as an outer multi-spherical approximation of the spheroid with the proximity ε . A fast heuristic algorithm is proposed to construct an optimized ε -cover giving a reasonable balance between the value of the proximity parameter ε and the number of spheres used. Computational results are provided to demonstrate the efficiency of the approach. © 2020 by the authors.

Pankratov, A., Romanova, T., Litvinchev, I., & Marmolejo-Saucedo, J. A. (2020). An optimized covering spheroids by spheres. *Applied Sciences (Switzerland)*, 10(5). doi: 10.3390/app10051846. Article.

José Antonio Marmolejo Saucedo

SNI Nivel II

Román Rodríguez Aguilar

SNI Nivel II

BACKBONE DISTRIBUTION NETWORK DESIGN FOR THE MEXICAN AUTOMOTIVE INDUSTRY

ABSTRACT. The logistics network of an automotive company in Mexico was analyzed to propose a better logistics network in the country to improve delivery times to customers. The analysis was conducted with Greenfield Analysis and Network Optimization. Taking into account the information given by the company, it was possible to obtain optimal scenarios for better operation, which involved the construction of distribution centers in the Hidalgo state in Mexico. © Springer Nature Switzerland AG 2020.

Retana-Blanco B., Marmolejo-Saucedo J. A., Rodríguez-Aguilar R., & Pedraza-Arroyo E. (2020). Backbone distribution network design for the mexican automotive industry. In Vasant, P., Litvinchev, I., Marmolejo-Saucedo, J. A., Rodríguez-Aguilar, R., Martínez-Ríos, F. (eds.), *Data Analysis and Optimization for Engineering and Computing Problems. EAI/Springer Innovations in Communication and Computing* (pp. 41-60). Cham, Switzerland: Springer. doi: 10.1007/978-3-030-48149-0_4. Book Chapter.

José Antonio Marmolejo Saucedo

SNI Nivel II

BINARY MONKEY ALGORITHM FOR APPROXIMATE PACKING NON-CONGRUENT CIRCLES IN A RECTANGULAR CONTAINER

ABSTRACT. A Packing problem consists in the best arrangement of several objects inside a bounded area named as the container. This arrangement must fulfill with technological constraints, for example, objects should not be overlapping. Some packing models for circular objects are typically formulated as non-convex optimization problems; where the continuous variables are the coordinates of the objects, so they are limited to not finding optimal solutions. Due to the combinatorial nature in the arrangement of such objects, heuristic methods are being used extensively which combine methods of global search and methods of local exhaustive search of local minima or their approximations. In this paper, we will address the packing problem for non-congruent (different size) circles with the binary version of the monkey algorithm which incorporates a cooperation process and a greedy strategy. We use a rectangular grid for covering the container. Every node in the grid represent potential positions for a circle. In this sense, binary monkey algorithm for the knapsack problem, can be used to solve de 0-1 approximate packing problem for non-congruent circles. The binary monkey problem uses two additional processes of the original monkey algorithm, these two processes are a greedy process and a cooperation processes.

Torres-Escobar, R., Marmolejo-Saucedo, J. A., & Litvinchev I. (2020). Binary monkey algorithm for approximate packing non-congruent circles in a rectangular container. *Wireless Networks*, 26(7), 4743-4752. doi: 10.1007/s11276-018-1869-y. Article.

José Antonio Marmolejo Saucedo

SNI Nivel II

COMPRESS SENSING ALGORITHM FOR ESTIMATION OF SIGNALS IN SENSOR NETWORKS

ABSTRACT. In this research, we present a data recovery scheme for wireless sensor networks. In some sensor networks, each node must be able to recover the complete information of the network, which leads to the problem of the high cost of energy in communication and storage of information. We proposed a modified gossip algorithm for acquire distributed measurements and communicate the information across all nodes of the network using compressive sampling and Gossip algorithms to compact the data to be stored and transmitted through a network. The experimental results on synthetic data

show that the proposed method reconstruct better the signal and in less iterations than with a similar method using a thresholding algorithm.

Martínez J., Mejía J., Mederos B., Ochoa A., Cruz-Mejía O., & Marmolejo-Saucedo J. A. (2020). Compress sensing algorithm for estimation of signals in sensor networks. *Wireless Networks*, 26(8), 5681-5688. doi: 10.1007/s11276-019-02031-5. Article.

José Antonio Marmolejo Saucedo

SNI Nivel II

Román Rodríguez Aguilar

SNI Nivel II

CONCEPTUAL FRAMEWORK OF DIGITAL HEALTH PUBLIC EMERGENCY SYSTEM: DIGITAL TWINS AND MULTIPARADIGM SIMULATION

ABSTRACT. INTRODUCTION: Two major technological paradigms have been developed in recent years, digital twins and the multiparadigm simulation. In the Health Sector, the enormous potential of both approaches for the management of public health emergencies is envisioned. OBJECTIVES: This study aims to develop the conceptual framework for the development of a Digital Public Health Emergency System. METHODS: The integration of the digital twins in health with the multi-paradigm simulation for the design of a digital system of public health emergencies is proposed. RESULTS: The proposal establishes the conceptual framework for the integration of a digital public health emergency system, incorporating multi-paradigm simulation in the construction of a digital twin. CONCLUSION: The use of cutting-edge technologies for public health emergencies will allow for a better response to contingencies as well as optimally managing the resources available in a health system.

Rodríguez-Aguilar, R. & Marmolejo-Saucedo, J. A. (2020). Conceptual framework of digital health public emergency system: Digital twins and multiparadigm simulation. *EAI Endorsed Transactions on Pervasive Health and Technology*, 6(21). doi: 10.4108/eai.13-7-2018.164261. Article.

José Antonio Marmolejo Saucedo

SNI Nivel II

DESIGN AND DEVELOPMENT OF DIGITAL TWINS: A CASE STUDY IN SUPPLY CHAINS

ABSTRACT. Digital twin technology consists of creating virtual replicas of objects or processes that simulate the behavior of their real counterparts. The objective is to analyze its effectiveness or behavior in certain cases to improve its effectiveness. Applied to products, machines and even complete busi-

ness ecosystems, the digital twin model can reveal information from the past, optimize the present and even predict the future performance of the different areas analyzed. In the context of supply chains, digital twins are changing the way they do business, providing a range of options to facilitate collaborative environments and data-based decision making and making business processes more robust. This paper proposes the design and development of a digital twin for a case study of a pharmaceutical company. The technology used is based on simulators, solvers and data analytic tools that allow these functions to be connected in an integral interface for the company. © 2020, Springer Science+Business Media, LLC, part of Springer Nature.

Marmolejo-Saucedo, J. A. (2020). Design and Development of Digital Twins: a Case Study in Supply Chains. *Mobile Networks and Applications*, 25(6), 2141-2160. doi: 10.1007/s11036-020-01557-9. Article.

José Antonio Marmolejo Saucedo

SNI Nivel II

José Antonio Lozano Díez

SNI Nivel I

Román Rodríguez Aguilar

SNI Nivel II

DESIGNING A RESILIENT SUPPLY CHAIN: AN APPROACH TO REDUCE DRUG SHORTAGES IN EPIDEMIC OUTBREAKS

ABSTRACT. INTRODUCTION: Supply network design is a long-studied topic that has evolved to address disruptive situations. The risk of supply chain disruption leads to the development of resilient supply chains that are capable of reacting effectively. OBJECTIVES: In the context of public health, drug supply networks face shortage challenges in many situations, such as current epidemic outbreaks such as COVID-19. Drug shortages can occur due to manufacturing problems, lack of infrastructure, and immediate reaction mechanisms. METHODS: The case study is solved with anyLogistix optimization and simulation software. RESULTS: We present the results of a hypothetical study on the impact of COVID-19 on a regional supply network. The results of this research are intended to be the basis for the design of resilient supply chains in epidemic outbreaks. CONCLUSION: Drug providers should consider strategies to prevent or reduce the impact of shortages as well as disruption spreads. © 2020 Jose Antonio Lozano-Diez et al., licensed to EAI.

Lozano-Diez, J. A., Marmolejo-Saucedo, J. A., & Rodríguez-Aguilar, R. (2020). Designing a resilient supply chain: An approach to reduce drug shortages in epidemic outbreaks. *EAI Endorsed Transactions on Pervasive Health and Technology*, 6(21). doi: 10.4108/eai.13-7-2018.164260. Article.

José Antonio Marmolejo Saucedo

SNI Nivel II

EFFICIENCY ANALYSIS FOR STOCHASTIC DYNAMIC FACILITY LAYOUT PROBLEM USING META-HEURISTIC, DATA ENVELOPMENT ANALYSIS AND MACHINE LEARNING

ABSTRACT. The facility layout problem (FLP) is a combinatorial optimization problem. The performance of the layout design is significantly impacted by diverse, multiple factors. The use of algorithmic or procedural design methodology in ranking and identification of efficient layout is ineffective. In this context, this study proposes a three-stage methodology where data envelopment analysis (DEA) is augmented with unsupervised and supervised machine learning (ML). In stage 1, unsupervised ML is used for the clustering of the criteria in which the layouts need to be evaluated using homogeneity. Layouts are generated using simulated annealing, chaotic simulated annealing, and hybrid firefly algorithm/chaotic simulated annealing meta-heuristics. In stage 2, the nonparametric DEA approach is used to identify efficient and inefficient layouts. Finally, supervised ML utilizes the performance frontiers from DEA (efficiency scores) to generate a trained model for getting the unique rankings and predicted efficiency scores of layouts. The proposed methodology overcomes the limitations associated with large datasets that contain many inputs / outputs from the conventional DEA and improves the prediction accuracy of layouts. A Gaussian distribution product demand dataset for time period $T = 5$ and facility size $N = 12$ is used to prove the effectiveness of the methodology. © 2019 Wiley Periodicals, Inc.

Tayal, A., Kose, U., Solanki, A., Nayyar, A., & Saucedo, J. A. M. (2019). Efficiency analysis for stochastic dynamic facility layout problem using meta-heuristic, data envelopment analysis and machine learning. *Computational Intelligence*, 36(1), 172-202. doi: 10.1111/coin.12251. Article.

José Antonio Marmolejo Saucedo

SNI Nivel II

Román Rodríguez Aguilar

SNI Nivel II

FINANCIAL FRAUD DETECTION THROUGH ARTIFICIAL INTELLIGENCE

ABSTRACT. According to the literature review performed, there are few methods focused on the study of qualitative and quantitative variables when making demand projections by using fuzzy logic and artificial neural networks. The purpose of this research is to build a hybrid method for integrating demand forecasts generated from expert judgements and historical data and application in the automotive industry.

Demand forecasts through the integration of variables; expert judgements and historical data using fuzzy logic and neural network. The methodology includes the integration of expert and historical data applying the Delphi method as a means of collecting fuzzy data. The result according to proposed methodology shows how fuzzy logic and neural networks is an alternative for demand planning activity. Machine learning techniques are techniques that generate alternatives for the tools development for demand forecasting. In this study, qualitative and quantitative variables are integrated through the implementation of fuzzy logic and time series artificial neural networks. The study aims to focus in manufacturing industry factors in conjunction time series data.

Rodríguez-Aguilar, R., Marmolejo-Saucedo, J. A., Vasant, P., & Litvinchev, I. (2020). Financial Fraud Detection Through Artificial Intelligence. In Hemanth D. & Kose U. (eds.), *Artificial Intelligence and Applied Mathematics in Engineering Problems. ICAIAME 2019. Lecture Notes on Data Engineering and Communications Technologies*, vol. 43, (pp. 57-72). Cham, Switzerland: Springer. doi: 10.1007/978-3-030-36178-5_6. Book Chapter.

José Antonio Marmolejo Saucedo

SNI Nivel II

Román Rodríguez Aguilar

SNI Nivel II

LIBERALIZATION OF THE MEXICAN ELECTRICITY SECTOR: A STUDY OF TECHNICAL EFFICIENCY

ABSTRACT. This article discusses the recent reform implemented in the Mexican electricity sector. As part of the structural reforms carried out in Mexico during the last 6 years (2012-2018), the opening of this sector to foreign capital, the creation of a wholesale electricity market, and the end of the monopoly of a CFE (Federal Electricity Commission, a government company) are the main changes. This study addresses an estimation of technical efficiency of power thermal units within the framework of the liberalization of the Mexican electricity market. These estimations are relevant because a single supplier, even before liberalization, must form a portfolio of the most efficient plants to be able to compete in the electricity market. The main results show the composition of a set of power thermal plants that are the most efficient of the total number of plants in operation and that could represent CFE in the wholesale electricity market.

Rodríguez-Aguilar, R. & Marmolejo-Saucedo, J. A. (2019). Liberalization of the Mexican electricity sector: A study of technical efficiency. In Vasant P., Litvinchev I., Marmolejo-Saucedo J. (eds.), *Innovative Computing Trends and Applications. EAI/Springer Innovations in Communication and Computing* (pp. 39-51). Cham, Switzerland: Springer. doi: 10.1007/978-3-030-03898-4_5. Book Chapter.

José Antonio Marmolejo Saucedo

SNI Nivel II

Román Rodríguez Aguilar

SNI Nivel II

NATURE-INSPIRED META-HEURISTICS APPROACHES FOR CHARGING PLUG-IN HYBRID ELECTRIC VEHICLE

ABSTRACT. Currently, there is a remarkable focus on green technologies for taking steps towards more use of renewable energy sources within the sector of transportation and also decreasing pollution. At this point, employment of plug-in hybrid electric vehicles (PHEVs) needs sufficient charging allocation strategy, by running smart charging infrastructures and smart grid systems. In order to daily usage of PHEVs, daytime charging stations are required and at this point, only an appropriate charging control and a management of the infrastructure can lead to wider employment of PHEVs. In this study, four swarm intelligence based optimization techniques: particle swarm optimization (PSO), gravitational search algorithm (GSA), accelerated particle swarm optimization, and hybrid version of PSO and GSA (PSO-GSA) have been applied for the state-of-charge optimization of PHEVs. In this research, hybrid PSO-GSA has performed very well in producing better results than other stand-alone optimization techniques. © 2019, Springer Science+Business Media, LLC, part of Springer Nature.

Vasant P., Marmolejo J. A., Litvinchev I., & Aguilar R. R. (2020). Nature-inspired meta-heuristics approaches for charging plug-in hybrid electric vehicle. *Wireless Networks*, 26(7), 4753-4766. doi: 10.1007/s11276-019-01993-w. Article.

José Antonio Marmolejo Saucedo

SNI Nivel II

OPTIMIZATION OF THE DISTRIBUTION NETWORK USING AN EMERGING TECHNOLOGY

ABSTRACT. Unmanned Aerial Vehicles (UAVs) are a technology that has recently been incorporated in the distribution of products, which in this study, are packages. It can improve the distribution system in environments where there is significant traffic congestion. Furthermore, UAV can help to deliver small packages between warehouses, by using them as an alternative means of distribution. The incursion is of an emerging technology, in this case the use of drones, for a new delivery system in order to improve a university distribution system, in the view of the fact that in recent years, companies have focused on the use of logistics operations for the improvement of productivity and delivery times.

The study presents a mathematical model, based on the Problem of the Traveling Salesman (TSP) for the planning of a route to increase the efficiency in the distribution process at Ciudad Universitaria, an Universidad Autonoma de Nuevo Leon (UANL) campus that contemplates the use of the emerging technology of UAVs, and the traditional method of using trucks. The model considers restrictions on the use of drones, such as the limitation of travel times and maximum distance. © 2020 by the author. Licensee MDPI, Basel, Switzerland.

Hernández, E. J. U., Martínez, J. A. S., & Saucedo, J. A. M. (2020). Optimization of the distribution network using an emerging technology. *Applied Sciences (Switzerland)*, 10(3). doi: 10.3390/app10030857. Article.

José Antonio Marmolejo Saucedo

SNI Nivel II

OPTIMIZATION OF THE STORAGE LOCATION ASSIGNMENT AND THE PICKER-ROUTING PROBLEM BY USING MATHEMATICAL PROGRAMMING

ABSTRACT. The order picking process involves a series of activities in response to customer needs, such as the selection or programming of orders (batches), and the selection of different items from their storage location to shipment. These activities are accomplished by a routing policy that determines the picker sequence for retrieving the items from the storage location. Therefore, the order picking problem has been plenty investigated; however, in previous research, the proposed models were based on demand fulfilling, putting aside factors such as the product weight-which is an important criterion-at the time of establishing routes. In this article, a mathematical model is proposed; it takes into account the product's weight derived from a case study. This model is relevant, as no similar work was found in the literature that improves the order picking by making simultaneous decisions on the storage location assignment and the picker-routing problem, considering precedence constraints based on the product weight and the characteristics of the case study, as the only location for each product in a warehouse with a general layout. © 2020 by the authors.

Zuñiga, J. B., Martínez, J. A. S., Fierro, T. E. S., & Saucedo, J. A. M. (2020). Optimization of the storage location assignment and the picker-routing problem by using mathematical programming. *Applied Sciences (Switzerland)*, 10(2). doi: 10.3390/app10020534. Article.

José Antonio Marmolejo Saucedo

SNI Nivel II

OPTIMIZED PACKING OF OBJECT CLUSTERS WITH BALANCING CONDITIONS

ABSTRACT. Packing clusters composed of non-overlapping non-identical convex objects is considered. The packing problem, originally stated in Romanova et al. (Math Probl Eng 2019:Article ID 4136430, 12 pages, 2019), is extended here by introducing balancing (equilibrium) conditions. Packing clusters into a rectangular container is considered. Objects in the cluster are of the same shape and allowed to be continuously translated and rotated subject to maximum distance between clusters. This problem is referred to as a sparse equilibrium packing of clusters and formulated as a nonlinear optimization problem. An algorithmic approach to find a locally optimal solution is developed. Computational results are presented to support efficiency of the method for packing clusters with and without balancing conditions. © Springer Nature Switzerland AG 2020.

Romanova, T., Pankratov, A., Litvinchev, I., & Marmolejo-Saucedo, J. A. (2020). Optimized packing of object clusters with balancing conditions. In Vasant, P., Litvinchev, I., Marmolejo-Saucedo, J. A., Rodríguez-Aguilar, R., Martínez-Ríos F. (eds.), *Data Analysis and Optimization for Engineering and Computing Problems. EAI/Springer Innovations in Communication and Computing* (pp. 95-108). Cham, Switzerland: Springer. doi: 10.1007/978-3-030-48149-0_8. Book Chapter.

José Antonio Marmolejo Saucedo

SNI Nivel II

RELIABLE AND SECURE DATA TRANSFER IN IOT NETWORKS

ABSTRACT. With the rapid technological improvements in mobile devices and their inclusion in Internet of Things (IoT), secure key management becomes mandatory to ensure security of information exchange. For instance, IoT applications, such as smart health-care and smart homes, provide automated services to the users with less or no user intervention. As these application use user-sensitive data, ensuring their security and privacy should be paramount, especially during the key management process. However, traditional approaches for key management will not suit well in IoT environment because of the inherent resource constraint property of IoT devices. In this paper, we propose a novel distributed key management scheme for IoT ecosystem. The proposed scheme efficiently provides security to IoT devices by delegating most of the resource consuming cryptographic processing to a local entity. This entity coordinates with other

peer entities to provide a distributed key as well as an authentication mechanism to network devices. In particular, the proposed scheme exploits the advantages of mobile agents by deploying them in different subnetworks as and when required: (1) to process the cryptography work for the IoT devices, and (2) to act as an local authenticated entity to perform fast authentication process. To verify the effectiveness and correctness of our proposed scheme, we have simulated it in a large IoT scenario and evaluated against relevant metrics that includes user mobility, certification generation time, and communication overhead.

Gochhayat S. P., Lal C., Sharma L., Sharma, D. P., Gupta, D., Saucedo, J. A. M., & Kose U. (2020). Reliable and secure data transfer in IoT networks. *Wireless Networks*, 26(8), 5689-5702. doi: 10.1007/s11276-019-02036-0. Article.

José Antonio Marmolejo Saucedo

SNI Nivel II

Román Rodríguez Aguilar

SNI Nivel II

STATISTICAL LEARNING APPLIED TO MALWARE DETECTION

ABSTRACT. This work shows an application of statistical learning methodologies in order to determine the important factors for malware detection. Support Vector Machines and Lasso Regression performed Malware classification with additional re-sampling methods. The results show that the Lasso Regression allows an efficient selection of relevant variables for the construction of the classifier, also the integration of support vector machines improves the efficiency of the classifier through the application of resampling methods. The model presented in this paper uses a statistical learning approach through the selection of variables, nonlinear classification, and resampling methods. © 2020, Springer Nature Switzerland AG.

Rodríguez-Aguilar, R. & Marmolejo-Saucedo, J. A. (2020). Statistical Learning Applied to Malware Detection. In Hemanth D. & Kose U. (eds.), *Artificial Intelligence and Applied Mathematics in Engineering Problems. ICAIAME 2019. Lecture Notes on Data Engineering and Communications Technologies*, vol. 43, (pp. 276-294). Cham, Switzerland: Springer. doi: 10.1007/978-3-030-36178-5_22. Book Chapter.

José Antonio Marmolejo Saucedo

SNI Nivel II

Isabel Joaquína Niembro García

Profesor investigador

STRUCTURAL DYNAMICS OF LOGISTIC NETWORKS: A SUSTAINABLE APPROACH

ABSTRACT. This paper addresses the problem of designing logistics networks under a sustainability approach. The Life Cycle Assessment (LCA) methodology is used to assess the environmental burdens associated with goods or services. The goal of this LCA is to characterize the paths of the network in a study, to offer a new optimization parameter. The process is carried out by hybridizing the classical approach of network optimization and the LCA methodology. Finally, a real case study is presented with 4 plants and 50 clients where the proposed methodology is applied. Two real scenarios are compared. The results show that a crossdocking strategy obtains the least environmental impact in its operation.

Marmolejo-Saucedo, J. A., Niembro-García, J., & Alva-Guerra, L. F. (2019). Structural dynamics of logistic networks: A sustainable approach. *IFAC PapersOnLine*, 52(13), 2704-2709. doi: 10.1016/j.ifacol.2019.11.616. Article.

José Antonio Marmolejo Saucedo

SNI Nivel II

Román Rodríguez Aguilar

SNI Nivel II

TECHNICAL EVALUATION OF THE OPENING OF FACILITIES IN THE PHARMACEUTICAL INDUSTRY: OPTIMIZATION TO SUPPLY CHAIN IN MEXICO

ABSTRACT. The pharmaceutical industry is going through a difficult time in Mexico. Despite all the advances and improvements in the methods of production, storage and distribution, many pharmaceutical companies still struggle to meet market demand effectively and consistently. The risks faced by the supply chain of the pharmaceutical industry are diverse and typical of an industry dedicated to health care. So, the location to locate new facilities includes several strategic and tactical decisions that must consider aspects of production, distribution, material flow, optimal inventory, the perishability of products, safety, among other factors. The application of robust hybrid models will allow obtaining the best solutions, taking into account the network optimization, greenfield analysis and risk scenarios. This paper presents a case study for a pharmaceutical company that operates in Mexico and plans to expand its operations seeking the optimal oper-

ation of the supply chain. The inherent risks to a supply chain of pharmaceutical products, different scenarios and parameters were considered, which will allow making decisions based on technical evidence in order to improve the performance of the company. Modelling the expansion of operations and the performance of the supply chain was carried out using the specialized software Anylogistix. © 2019, IFAC (International Federation of Automatic Control) Hosting by Elsevier Ltd. All rights reserved.

Marmolejo-Saucedo, J. A., Rodríguez-Aguilar, R., & Manuell-Barrera, O. S. G. (2019). Technical evaluation of the opening of facilities in the pharmaceutical industry: optimization to supply chain in Mexico. *IFAC PapersOnLine*, 52(13), 2692-2697. doi: 10.1016/j.ifacol.2019.11.614. Article.

José Antonio Marmolejo Saucedo

SNI Nivel II

Román Rodríguez Aguilar

SNI Nivel II

TEXT MINING AND STATISTICAL LEARNING FOR THE ANALYSIS OF THE VOICE OF THE CUSTOMER

ABSTRACT. This paper analyzes the content of texts through a Text Mining classification model for the particular case of the Tweets made about the Miniso brand in Mexico during the period from November 17 to 24, 2018. The analysis involves the extraction of the data, the cleaning of the text and supervised support models for high-dimensional data, obtaining as a result the classification of the tweets in the topics: Positive, Negative, Advertising or Requirements of new Branches. As well as the use of resampling techniques to measure the variability of the performance of the model and to improve the accuracy of the parameters. This practice allows to reduce time spent reading texts, especially in Social Networks, finding faster and more efficient trends that help decision-making and respond quickly to customer demand. © 2020, Springer Nature Switzerland AG.

González, R. A., Rodríguez-Aguilar, R., & Marmolejo-Saucedo, J. A. (2020). Text Mining and Statistical Learning for the Analysis of the Voice of the Customer. In Hemanth D. & Kose U. (eds.), *Artificial Intelligence and Applied Mathematics in Engineering Problems*. ICAIAME 2019. *Lecture Notes on Data Engineering and Communications Technologies*, vol. 43, (pp. 191-199). Cham, Switzerland: Springer. doi: 10.1007/978-3-030-36178-5_16. Book Chapter.

José Antonio Marmolejo Saucedo

SNI Nivel II

Román Rodríguez Aguilar

SNI Nivel II

THE SUPPLY CHAIN EVENT MANAGEMENT APPLICATION: A CASE STUDY

ABSTRACT. A deviation from planned processes reveals the consequences that a disruption can cause in any area, even more a disruption with Ripple Effect (RE), which implied for the global Supply Chain (SC) when depends essentially from the stakeholders in all levels and chains. The learnt lessons from these tragical events show that many companies could not assess the impact and its side effects, therefore they cannot respond adequately, prolonging the crisis and expanding the disruption. A disruption evaluation model would allow to know from the beginning the potential impact to check carefully into the critical events to provide the necessary resources to control it. Hence, it is relevant that SC managers know and employ the right tools to focus on the control and the solution; as well to evaluate the impact and the disruption criticality level to mitigate and control the impact with total certainty that the appropriate actions are being taken according to the problematic.

Palma, F., Saucedo, J. A., Marmolejo-Saucedo, J. A., & Rodríguez-Aguilar, R. (2019). The supply chain event management application: a case study. *IFAC PapersOnLine*, 52(13), 2698-2703. doi: 10.1016/j.ifacol.2019.11.615. Article.

José Antonio Marmolejo Saucedo

SNI Nivel II

TRENDS IN DIGITIZATION OF THE SUPPLY CHAIN: A BRIEF LITERATURE REVIEW

ABSTRACT. The latest advances in technology, reflected as the Industrial Revolution 4.0, have forced the digitization of supply chains and logistics in general. Only companies that can prepare for and embrace change will survive in the new business environment. Businesses in industries that do not adapt to the new rules of the game will become obsolete in market share. The transformation of a supply and logistics chain, from an old model to a digital one, requires strict organization. It is a great effort on a human level, with the ease of requiring low operating costs. The reward for achieving this change is openness to a global business, where the possibilities grow exponentially and proportionally with the capacity of the available work team. Big data emerges as the beginning of the digitization of supply chains and logistics in the global world. The new environment requires a permanent update

of the services software based on market needs. Generally, this does not imply changing technology immediately. However, the goal is to be ready for evolution when a novelty means improvement. This paper briefly presents the evolution of supply chains in the digital context of operational functions. © 2020 Jose Antonio Marmolejo-Saucedo et al., licensed to EAI.

Marmolejo-Saucedo, J. A. & Hartmann, S. (2020). Trends in digitization of the supply chain: A brief literature review. *EAI Endorsed Transactions on Energy Web*, 7(29). doi: 10.4108/EAI.13-7-2018.164113. Article.

José Antonio Marmolejo Saucedo

SNI Nivel II

VERTICAL AND HORIZONTAL INTEGRATION SYSTEMS IN INDUSTRY 4.0 (ARTICLE)

ABSTRACT. Industrial and technological growth, sponsored by the new organizational systems generated by the fourth industrial revolution, require adapt new business management ways in the companies. Within the organizational and business area we can conceive all activities as an operations set that are linked to computer systems and information management in the network, achieving more efficiency in the flow, in addition, this new industry perception and businesses includes different analytical tools which are useful to support the customer service efficiency improvement. The research objective is to propose and validate a methodological tool, for evaluating the technological and operational criteria within companies and place them in the right level for a transfer to the new industrial revolution, considering as well the vertical and horizontal systems in Industry 4.0. © 2018, Springer Science+Business Media, LLC, part of Springer Nature.

Pérez-Lara, M., Saucedo-Martínez, J. A., Marmolejo-Saucedo, J. A., Salas-Fierro, T. E., & Vasant P. (2018). Vertical and horizontal integration systems in Industry 4.0. *Wireless Networks*, 26(7), 4767-4775. doi: 10.1007/s11276-018-1873-2. Article.

José Antonio Marmolejo Saucedo

SNI Nivel II

VERTICAL AND HORIZONTAL INTEGRATION SYSTEMS IN INDUSTRY 4.0 (BOOK CHAPTER)

ABSTRACT. The industrial and technological growth, sponsored by the new organizational systems generated by the Fourth Industrial Revolution, requires companies to adapt to new ways of managing business. All activities within the organizational and business area can be conceived as a set of operations that are linked to computer systems and infor-

mation management in the network. As a result of this, a greater efficiency in the flow is accomplished. Moreover, with this new industry and business perception, different analytical tools have to be involved to get the greater efficiency in the consumer service. The objective of this research is to propose a methodological tool and validate it, which assess technological and operational criteria in companies, to place them in a level for the transfer to the new Industrial Revolution, considering the vertical and horizontal integration systems of Industry 4.0. © Springer Nature Switzerland AG 2019.

Pérez-Lara, M., Saucedo-Martínez, J. A., Salais-Fierro, T. E., Marmolejo-Saucedo, J. A., & Vasant, P. (2019). Vertical and horizontal integration systems in industry 4.0. In Chlamtac, I. (ed.), *EAI/Springer Innovations in Communication and Computing* (pp. 99-109). Cham, Switzerland: Springer. doi: 10.1007/978-3-030-03898-4_11. Book Chapter.

Félix Orlando Martínez Ríos

Investigador Titular C, SNI Nivel I

A FIRST-YEAR DESIGN EXPERIENCE BASED ON SAE AERO DESIGN CONTEST TO SUPPORT ABET LEARNING OUTCOMES AND ENGINEERING VOCATION IN FRESHMEN STUDENT

ABSTRACT. The a-k outcomes established by Accreditation Board for Engineering and Technology (ABET) for Engineering students in their self-assessment framework, should be reflected in the different subjects that taught to the students of the first two years of the various engineering programs. On the other hand, in those first semesters, the vocation of the students about the different Engineering is not very well defined. This experiment shows a proposal that links the results of ABET with an international student competition such as Society of Automotive Engineers (SAE) Aero Design, to reinforce and guide the new students in their future choice of specialization in the School of Engineering. We also show the relationship between the challenges and problems in the SAE Aero Design competition for new students and ABET's a-k outcomes. We show the results obtained with nineteen students over three years. It is important to mention that none of the students involved in this experiment comes from Aeronautical Engineering (or similar to it). © American Society for Engineering Education, 2017.

Martínez-Ríos, F. (2017). A first-year design experience based on SAE Aero Design contest to support ABET learning outcomes and engineering vocation in freshmen student. *FYEE 2017 Conference*. 9th Annual First Year Engineering Experience Conference (United States), The Shores Resort and SpaDaytona Beach. Conference Paper.

Félix Orlando Martínez Ríos

Investigador Titular C, SNI Nivel I

A NEW APPROACH OF THE RAIN-FALL OPTIMIZATION ALGORITHM USING PARALLELIZATION

ABSTRACT. This chapter introduces a new implementation of the Rain-Fall Optimization Algorithm (RFO) proposed by Kaboli, Sevbaraj, and Rahim in "Rain-Fall Optimization Algorithm. A Population-Based Algorithm for Solving Constrained Optimization Problems" by Kaboli et al. (J Comput Sci 19:31-42, 2017). RFO is a nature-inspired algorithm, which is based on the behavior of the water drops produced by a rainfall going down through a mountain to find the minimum values of specific functions. The algorithm was tested on four multidimensional benchmark functions: Ackley, Griewank, Rosenbrock, and Sphere functions. It was also tested in a four-dimensional function, the Kowalik function. The first step was to match the results of the rewritten algorithm with the results obtained by the original authors. Then the algorithm had to be modified to make some efficiency improvements and to get better results. The main modifications were a new equation to modify the step size for a function called explosion process and a parallel execution of the algorithm with two different restarting techniques: restart to the best and genetic restart to the best. © Springer Nature Switzerland AG 2020.

Guerrero-Valadez, J. M. & Martínez-Ríos, F. (2020). A new approach of the rain-fall optimization algorithm using parallelization. In Vasant, P., Litvinchev, I., Marmolejo-Saucedo, J. A., Rodriguez-Aguilar, R., Martinez-Rios, F. (eds.), *Data Analysis and Optimization for Engineering and Computing Problems*. EAI/Springer Innovations in Communication and Computing (pp. 13-26). Cham, Switzerland: Springer. doi: 10.1007/978-3-030-48149-0_2. Book Chapter.

Félix Orlando Martínez Ríos

Investigador Titular C, SNI Nivel I

A NEW HEURISTIC BASED ON A PARALLEL IMPLEMENTATION OF FIREFLY ALGORITHM

ABSTRACT. In this chapter, a new optimization algorithm is introduced, inspired by the Firefly Algorithm, which is based on the behavior of fireflies, especially on their flashing characteristics. This new algorithm runs C parallel executions of the algorithm that, after a determined number of iterations, are paused and their results are compared so that, using different restarting techniques, new positions for the fireflies in each thread are determined to continue the executions. This parallel implementation allows us to have more diversity in the experiments, allowing the Firefly Algorithm to obtain better results. For

testing the restarting techniques mentioned before, we used 6 multimodal benchmark functions: Step, Sphere, Sum Square, Trid 10, Zakharov, and Rosenbrock functions. For this chapter, different tests were performed to determine the value of the parameters needed to run the algorithm. These values were used to run the final experiments. The results obtained with the implementation of our algorithm with the different restarting techniques and the parameters established are compared to the results published by other authors so that we were able to prove the efficiency of this new algorithm. We obtained significantly better results in some of the test functions, proving that our algorithm is a breakthrough in nature-inspired algorithms. © Springer Nature Switzerland AG 2020.

Murillo-Suárez A. & Martínez-Ríos F. (2020). A new heuristic based on a parallel implementation of firefly algorithm. In Vasant, P., Litvinchev, I., Marmolejo-Saucedo, J. A., Rodríguez-Aguilar, R., Martínez-Ríos, F. (eds.), *Data Analysis and Optimization for Engineering and Computing Problems. EAI/Springer Innovations in Communication and Computing* (pp. 13-26). Cham, Switzerland: Springer (pp. 3-12). doi: 10.1007/978-3-030-48149-0_1. Book Chapter.

Félix Orlando Martínez Ríos

Investigador Titular C, SNI Nivel I

A NEW HEURISTIC WITH A MULTI-THREADED IMPLEMENTATION OF A MODIFIED FIREFLY ALGORITHM

ABSTRACT. In this article, we present a modified version of the Firefly Algorithm implemented in a multi-threaded model to improve the results obtained by the original algorithm significantly. This multi-threaded algorithm allows the threads to obtain different results by the independent execution of the heuristic method in each of them, although for keeping all the threads with significant executions, the algorithm performs some crossover techniques, explained in detail in this article, for the threads to learn between them while maintaining its independence. For testing the new algorithm, we use the six benchmark functions used in the literature for testing the original Firefly Algorithm, and to prove that the improved results are significant, we perform the Wilcoxon test to the results obtained. The results obtained with this new heuristic proved to be significantly better while taking advantage of today's commercial processors.

Murillo-Suárez, A. & Martínez-Ríos, F. (2020). A new heuristic with a multi-threaded implementation of a modified firefly algorithm. *EAI Endorsed Transactions on Energy Web*, 7(29). doi: 10.4108/eai.13-7-2018.163984. Article.

Félix Orlando Martínez Ríos

Investigador Titular C, SNI Nivel I

DISTRIBUTED AND MULTICORE QUBILS-MIDAS SOFTWARE V2.0: COMPUTING CHIRAL, FUZZY, WEIGHTED AND TRUNCATED GEOMETRICAL MOLECULAR DESCRIPTORS BASED ON TENSOR ALGEBRA

ABSTRACT. Advances to the distributed, multi-core and fully cross-platform QuBiLS-MIDAS software v2.0 (<http://tomocomd.com/qubils-midas>) are reported in this article since the v1.0 release. The QuBiLS-MIDAS software is the only one that computes atom-pair and alignment-free geometrical MDs (3D-MDs) from several distance metrics other than the Euclidean distance, as well as alignment-free 3D-MDs that codify structural information regarding the relations among three and four atoms of a molecule. The most recent features added to the QuBiLS-MIDAS software v2.0 are related (a) to the calculation of atomic weightings from indices based on the vertex-degree invariant (e.g., Alikhanidi index); (b) to consider central chirality during the molecular encoding; (c) to use measures based on clustering methods and statistical functions to codify structural information among more than two atoms; (d) to the use of a novel method based on fuzzy membership functions to spherically truncate inter-atomic relations; and (e) to the use of weighted and fuzzy aggregation operators to compute global 3D-MDs according to the importance and/or interrelation of the atoms of a molecule during the molecular encoding. Moreover, a novel module to compute QuBiLS-MIDAS 3D-MDs from their headings was also developed. This module can be used either by the graphical user interface or by means of the software library. By using the library, both the predictive models built with the QuBiLS-MIDAS 3D-MDs and the QuBiLS-MIDAS 3D-MDs calculation can be embedded in other tools. A set of predefined QuBiLS-MIDAS 3D-MDs with high information content and low redundancy on a set comprised of 20,469 compounds is also provided to be employed in further cheminformatics tasks. This set of predefined 3D-MDs evidenced better performance than all the universe of Dragon (v5.5) and PaDEL oD-to-3D MDs in variability studies, whereas a linear independence study proved that these QuBiLS-MIDAS 3D-MDs codify chemical information orthogonal to the Dragon oD-to-3D MDs. This set of predefined 3D-MDs would be periodically updated as long as new results be achieved. In general, this report highlights our continued efforts to provide a better tool for a most suitable characterization of compounds, and in this way, to contribute to obtaining better outcomes in future applications. © 2020 Wiley Periodicals, Inc.

García-Jacas, C. R., Marrero-Ponce, Y., Vivas-Reyes, R., Suárez-Lezcano, J., Martínez-Ríos, F., Terán, J. E., & Aguilera-Mendoza, L. (2020). Distributed and multi-core QuBiLS-MIDAS software v2.0: Computing chiral, fuzzy, weighted and truncated geometrical molecular descriptors based on tensor algebra. *Journal of Computational Chemistry*, 41(12), 1209-1227. doi: 10.1002/jcc.26167. Article.

Félix Orlando Martínez Ríos

Investigador Titular C, SNI Nivel I

PACKING ALGORITHM INSPIRED BY GRAVITATIONAL AND ELECTROMAGNETIC EFFECTS

ABSTRACT. This paper introduces a faster and more efficient algorithm for solving a two-dimension packing problem. This common optimization problem takes a set of geometrical objects and tries to find the best form of packing them in a space with specific characteristics, called container. The visualization of nanoscale electromagnetic fields was the inspiration for this new algorithm, using the electromagnetic field between the previously placed objects, this paper explains how to determine the best positions for to place the remaining ones. Two gravitational phenomena are also simulated to achieve better results: shaken and gravity. They help to compact the objects to reduce the occupied space. This paper shows the executions of the packing algorithm for four types of containers: rectangles, squares, triangles, and circles. © 2019, Springer Science+Business Media, LLC, part of Springer Nature.

Martínez-Ríos, F. & Murillo-Suárez, A. (2020). Packing algorithm inspired by gravitational and electromagnetic effects. *Wireless Networks*, 26(18), 5631-5644. doi: 10.1007/s11276-019-02011-9. Article.

Félix Orlando Martínez Ríos

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RAIN-FALL OPTIMIZATION ALGORITHM WITH NEW PARALLEL IMPLEMENTATIONS

ABSTRACT. Rainfall Optimization Algorithm (RFO) is a nature-inspired metaheuristic optimization algorithm. RFO mimics the movement of water drops generated during rainfall to optimize a function. The paper study new implementations for RFO to offer more reliable results. Moreover, it studies three restarting techniques that can be applied to the algorithm with multithreading. The different implementations for the RFO are benchmarked to test and verify the performance and accuracy of the solutions. The paper presents and compares the results using several multidimensional testing functions, as well as the visual

behavior of the raindrops inside the benchmark functions. The results confirm that the movement of the artificial drops corresponds to the natural behavior of raindrops. The results also show the effectiveness of this behavior to minimize an optimization function and the advantages of parallel computing restarting techniques to improve the quality of the solutions. © 2020 Juan Manuel Guerrero-Valadez et al.

Guerrero-Valadez, J. M. & Martínez-Ríos, F. (2020). Rain-fall optimization algorithm with new parallel implementations. *EAI Endorsed Transactions on Energy Web*, 7(29). doi: 10.4108/eai.13-7-2018.163981. Article.

Félix Orlando Martínez Ríos

Investigador Titular C, SNI Nivel I

SMOOTHED SPHERICAL TRUNCATION BASED ON FUZZY MEMBERSHIP FUNCTIONS: APPLICATION TO THE MOLECULAR ENCODING

ABSTRACT. A novel spherical truncation method, based on fuzzy membership functions, is introduced to truncate interatomic (or interaminoacid) relations according to smoothing values computed from fuzzy membership degrees. In this method, the molecules are circumscribed into a sphere, so that the geometric centers of the molecules are the centers of the spheres. The fuzzy membership degree of each atom (or aminoacid) is computed from its distance with respect to the geometric center of the molecule, by using a fuzzy membership function. So, the smoothing value to be applied in the truncation of a relation (or interaction) is computed by averaging the fuzzy membership degrees of the atoms (or aminoacids) involved in the relation. This truncation method is rather different from the existing ones, at considering the geometric center for the whole molecule and not only for atom-groups, as well as for using fuzzy membership functions to compute the smoothing values. A variability study on a set comprised of 20,469 compounds (15,050 drug-like compounds, 2994 drugs approved, 880 natural products from African sources, and 1545 plant-derived natural compounds exhibiting anti-cancerous activity) demonstrated that the truncation method proposed allows to determine molecular encodings with better ability for discriminating among structurally different molecules than the encodings obtained without applying truncation or applying non-fuzzy truncation functions. Moreover, a principal component analysis revealed that orthogonal chemical information of the molecules is encoded by using the method proposed. Lastly, a modeling study proved that the truncation method improves the modeling ability of existing geometric molecular descriptors, at allowing to develop more robust models than the ones built only using non-truncated descriptors. In this sense, a com-

parison and statistical assessment were performed on eight chemical datasets. As a result, the models based on the truncated molecular encodings yielded statistically better results than 12 procedures considered from the literature. It can thus be stated that the proposed truncation method is a relevant strategy for obtaining better molecular encodings, which will be ultimately useful in enhancing the modeling ability of existing encodings both on small-to-medium size molecules and biomacromolecules. © 2019 Wiley Periodicals, Inc. © 2019 Wiley Periodicals, Inc.

García-Jacas, C. R., Marrero-Ponce, Y., Brizuela, C. A., Suárez-Lezcano, J., & Martínez-Ríos, F. (2020). Smoothed Spherical Truncation based on Fuzzy Membership Functions: Application to the Molecular Encoding. *Journal of Computational Chemistry*, 41(3), 203-217. doi: 10.1002/jcc.26089. Article.

Félix Orlando Martínez Ríos

Investigador Titular C, SNI Nivel I

José Antonio Marmolejo Saucedo

SNI Nivel II

μθ -EGF: A NEW MULTI-THREAD AND NATURE-INSPIRED ALGORITHM FOR THE PACKING PROBLEM

ABSTRACT. In this paper, the authors present a new algorithm efficient solution to the packing problem in two dimensions. The authors propose a new heuristic using the value of the electromagnetic field to determine the best position to place a circular object in a configuration of other circular objects previously packed. Also, this algorithm simulates two processes to compact objects already placed, inspired by gravitational forces, to minimize the empty space in the container and maximizing the number of objects in the container. To determine the efficacy of this algorithm, the authors carried out experiments with twenty-four instances. Parallel computing can contribute to making decision processes such as optimization and prediction more agile and faster. Real-time decision making involves the use of solution methodologies and algorithms. For this reason the present manuscript shows an alternative for the solution of a classic industry problem that must be solved quickly. Packaging optimization can help reduce waste of container material. The material used to transport the products can reduce its environmental impact due to an efficient packaging process. Light-weighting can also be accomplished by reducing the amount of packaging material used. © 2019 Wiley Periodicals, Inc. © 2019 Wiley Periodicals, Inc.

Martínez-Ríos, F., Marmolejo-Saucedo, J.A., García-Jacas, C. R., & Murillo-Suarez, A. (2020). μθ-EGF: A New Multi-Thread and Nature-Inspired Algorithm for the Packing Problem. *Mobile Networks and Applications*, 25(6), 2105-2117. doi: 10.1007/s11036-020-01558-8. Article.

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THE RELEVANCE OF CATARACT AS A RISK FACTOR FOR AGE-RELATED MACULAR DEGENERATION: A MACHINE LEARNING APPROACH

ABSTRACT. Age-related macular degeneration (AMD) is the leading cause of visual dysfunction and irreversible blindness in developed countries and a rising cause in underdeveloped countries. There is a current debate on whether or not cataracts are significant risk factors for AMD development. In particular, research regarding this association is so far inconclusive. For this reason, we aimed to employ here a machine-learning approach to analyze the relevance and importance of cataracts as a risk factor for AMD in a large cohort of Hispanics from Mexico. We conducted a nested case control study of 119 cataract cases and 137 healthy unmatched controls focusing on clinical data from electronic medical records. Additionally, we studied two single nucleotide polymorphisms in the CFH gene previously associated with the disease in various populations as positive control for our method. We next determined the most relevant variables and found the bivariate association between cataracts and AMD. Later, we used supervised machine-learning methods to replicate these findings without bias. To improve the interpretability, we detected the five most relevant features and displayed them using a bar graph and a rule-based tree. Our findings suggest that bilateral cataracts are not a significant risk factor for AMD development among Hispanics from Mexico. © 2019 by the authors.

Martínez-Velasco, A., Martínez-Villaseñor, L., Miralles-Pechuán, L., Pérez-Ortiz, A. C., Zenteno, J. C., & Estrada-Mena, F. J. (2019). The relevance of cataract as a risk factor for age-related macular degeneration: A machine learning approach. *Applied Sciences (Switzerland)*, 9(24). doi: 10.3390/app9245550. Article.

María de Lourdes Martínez Villaseñor

SNI Nivel I

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A METHODOLOGY BASED ON DEEP Q-LEARNING/GENETIC ALGORITHMS FOR OPTIMIZING COVID-19 PANDEMIC GOVERNMENT ACTIONS

ABSTRACT. Whenever countries are threatened by a pandemic, as is the case with the COVID-19 virus, governments need help to take the right actions to safeguard public health as well as to mitigate the negative effects on the economy. A restrictive approach can seriously damage the economy. Conversely, a relaxed one may put at risk a high percentage of the population. Other investigations in this area are focused on modelling the spread of the virus or estimating the impact of the different measures on its propagation. However, in this paper, we propose a new methodology for helping governments in planning the phases to combat the pandemic based on their priorities. To this end, we implement the SEIR epidemiological model to represent the evolution of the COVID-19 virus on the population. To optimize the best sequences of actions governments can take, we propose a methodology with two approaches, one based on Deep Q-Learning and another one based on Genetic Algorithms. The sequences of actions (confinement, self-isolation, two-meter distance or not taking restrictions) are evaluated according to a reward system focused on meeting two objectives: firstly, getting few people infected so that hospitals are not overwhelmed, and secondly, avoiding taking drastic measures which could cause serious damage to the economy. The conducted experiments evaluate our methodology based on the accumulated rewards during the established period. The experiments also prove that it is a valid tool for governments to reduce the negative effects of a pandemic by optimizing the planning of the phases. According to our results, the approach based on Deep Q-Learning outperforms the one based on Genetic Algorithms.

Miralles-Pechuán L., Jiménez F., Ponce H., & Martínez-Villaseñor L. (2020). A Methodology Based on Deep Q-Learning/Genetic Algorithms for Optimizing COVID-19 Pandemic Government Actions. *International Conference on Information and Knowledge Management*. 29th ACM International Conference on Information and Knowledge Management (UK), Ireland (pp. 1135-1144). doi: 10.1145/3340531.3412179. Conference Paper.

María de Lourdes Martínez Villaseñor

SNI Nivel I

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A SURVEY ON FREEZING OF GAIT DETECTION AND PREDICTION IN PARKINSON'S DISEASE

ABSTRACT. Most of Parkinson's disease (PD) patients present a set of motor and non-motor symptoms and behaviors that vary during the day and from day-to-day. In particular, freezing of gait (FOG) impairs their quality of life and increases the risk of falling. Smart technology like mobile communication and wearable sensors can be used for detection and prediction of FOG, increasing the understanding of the complex PD. There are surveys reviewing works on Parkinson and/or technologies used to manage this disease. In this review, we summarize and analyze works addressing FOG detection and prediction based on wearable sensors, vision and other devices. We aim to identify trends, challenges and opportunities in the development of FOG detection and prediction systems. © 2020, Springer Nature Switzerland AG.

Martínez-Villaseñor L., Ponce H., & Miralles-Pechuán L. (2020). A Survey on Freezing of Gait Detection and Prediction in Parkinson's Disease. In Martínez-Villaseñor, L., Herrera-Alcántara, O., Ponce, H., & Castro-Espinoza, F.A. (eds.). *Advances in Soft Computing. 19th Mexican International Conference on Artificial Intelligence, MICAI 2020, Mexico City, Mexico, October 12–17, 2020, Proceedings, Part I* (pp. 169-181). Cham, Switzerland: Springer. doi: 10.1007/978-3-030-60884-2_13. Book Chapter.

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SNI Nivel I

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Investigador Titular D, SNI Nivel I

ANALYSIS OF CONTEXTUAL SENSORS FOR FALL DETECTION

ABSTRACT. Falls are a major problem among older people and often cause serious injuries. It is important to have efficient fall detection solutions to reduce the time in which a person who suffered a fall receives assistance. Given the recent availability of cameras, wearable and ambient sensors, more research in fall detection is focused on combining different data modalities. In order to determine the positive effects of each modality and combination to improve the effectiveness of fall detection, a detailed assessment has to be done. In this paper, we analyzed different combinations of wearable devices, namely IMUs and EEG helmet, with grid of active infrared sensors for fall detection, with

the aim to determine the positive effects of contextual information on the accuracy in fall detection. We used short-term memory (LSTM) networks to enable fall detection from sensors raw data. For some activities certain combinations can be helpful to discriminate other activities of daily living (ADL) from falls. © 2019 IEEE.

Martínez-Villaseñor, L. & Ponce, H. (2019). Analysis of Contextual Sensors for Fall Detection. 2019 IEEE. 2019 IEEE 14th International Symposium on Autonomous Decentralized System (ISADS) (Netherlands), Utrecht. doi: 10.1109/ISADS45777.2019.9155641. Conference Paper.

María de Lourdes Martínez Villaseñor

SNI Nivel I

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COMPARATIVE ANALYSIS OF ARTIFICIAL HYDROCARBON NETWORKS VERSUS CONVOLUTIONAL NEURAL NETWORKS IN HUMAN ACTIVITY RECOGNITION

ABSTRACT. Human activity recognition (HAR) has gained interest in the research communities in order to know the behavior and context of users for medical, sports performance evaluation, ambient assisted living and security applications. Recent works suggest that convolutional neural networks (CNN) are very competitive machine learning techniques for HAR. Nevertheless, CNN require many computational resources, high number of parameter tuning, and many data samples for training. In this paper, we present a comparative analysis of a novel technique, artificial hydrocarbon networks (AHN), with CNN on human activity recognition classification task. We choose to compare AHN with CNN given that it is a very well-suited machine learning technique for HAR. We show that AHN architecture is simpler to set up than CNN, it needs less hyper-parameter configuration and has a slightly better accuracy performance. © 2020 IEEE.

Martínez-Villaseñor, L. & Ponce, H. (2020). Analysis of Contextual Sensors for Fall Detection. 2020 IEEE. 2020 International Joint Conference on Neural Networks (IJCNN) (UK), Glasgow. doi: 10.1109/IJCNN48605.2020.9206757. Conference Paper.

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SNI Nivel I

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Investigador Titular D, SNI Nivel I

DESIGN AND ANALYSIS FOR FALL DETECTION SYSTEM SIMPLIFICATION

ABSTRACT. This paper presents a methodology based on multimodal sensors to configure a simple, comfortable and fast fall detection and human activity recognition system that can be easily implemented and adopted. The methodology is based on the configuration of specific types of sensors, machine-learning methods and procedures. The protocol is divided into four phases: (1) database creation (2) data analysis (3) system simplification and (4) evaluation. Using this methodology, we created a multimodal database for fall detection and human activity recognition, namely UP-Fall Detection. It comprises data samples from 17 subjects that perform 5 types of falls and 6 different simple activities, during 3 trials. All information was gathered using 5 wearable sensors (tri-axis accelerometer, gyroscope and light intensity), 1 electroencephalograph helmet, 6 infrared sensors as ambient sensors, and 2 cameras in lateral and front viewpoints. The proposed novel methodology adds some important stages to perform a deep analysis of the following design issues in order to simplify a fall detection system: a) select which sensors or combination of sensors are to be used in a simple fall detection system, b) determine the best placement of the sources of information, and c) select the most suitable machine learning classification method for fall and human activity detection and recognition. Even though some multimodal approaches reported in literature only focus on one or two of the above-mentioned issues, our methodology allows simultaneously solving these three design problems related to a human fall and activity detection and recognition system. © 2020, Journal of Visualized Experiments. All rights reserved.

Martínez-Villaseñor, L. & Ponce, H. (2020). Design and analysis for fall detection system simplification. *Journal of Visualized Experiments*, 2020(158). doi: 10.3791/60361. Conference Paper.

María de Lourdes Martínez Villaseñor

SNI Nivel I

Hiram Eredín Ponce Espinosa

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ONLINE TESTING IN MACHINE LEARNING APPROACH FOR FALL DETECTION

ABSTRACT. Robust fall detectors are needed to reduce the time in which a person can receive medical assistance, and mitigate negative effects when a fall occurs. Robustness in fall detection systems is difficult to achieve given that there are still many challenges regarding performance in real conditions. Fall detection systems based on smartphones present good results following a traditional methodology of collecting data, training and evaluating classification models using the same sensors and subjects, yet fail to experiment and succeed in different realistic conditions. In this paper, we propose a methodology to build a solution for fall detection, and online testing changing the sensors and subjects of evaluation in order to provide a more flexible and portable fall detector. © 2020 IEEE.

Martínez-Villaseñor, L., Ponce, H., Núñez-Martínez, J., & Pacheco, S. (2020). Online Testing in Machine Learning Approach for Fall Detection. *IJCNN 2020. 2020 International Joint Conference on Neural Networks (IJCNN) (UK)*, Glasgow. doi: 10.1109/IJCNN48605.2020.9206763. Conference Paper.

María de Lourdes Martínez Villaseñor

SNI Nivel I

Hiram Eredín Ponce Espinosa

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SENSOR LOCATION ANALYSIS AND MINIMAL DEPLOYMENT FOR FALL DETECTION SYSTEM

ABSTRACT. Human falls are considered as an important health problem worldwide. Fall detection systems can alert when a fall occurs reducing the time in which a person obtains medical attention. In this regard, there are different approaches to design fall detection systems, such as wearable sensors, ambient sensors, vision devices, and more recently multimodal approaches. However, these systems depend on the types of devices selected for data acquisition, the location in which these devices are placed, and how fall detection is done. Previously, we have created a multimodal dataset namely UP-Fall Detection and we developed a fall detection system. But the latter cannot be applied on realistic conditions due to a lack of proper selection of minimal sensors. In this work, we propose a methodological analysis to determine the minimal number

of sensors required for developing an accurate fall detection system, using the UP-Fall Detection dataset. Specifically, we analyze five wearable sensors and two camera viewpoints separately. After that, we combine them in a feature level to evaluate and select the most suitable single or combined sources of information. From this analysis we found that a wearable sensor at the waist and a lateral viewpoint from a camera exhibits 98.72% of accuracy (intra-subject). At the end, we present a case study on the usage of the analysis results to deploy a minimal-sensor based fall detection system which finally reports 87.56% of accuracy (inter-subject).

Ponce, H., Martínez-Villaseñor, L., & Núñez-Martínez, J. (2020). Sensor Location Analysis and Minimal Deployment for Fall Detection System. *IEEE Access*, 8. doi: 10.1109/ACCESS.2020.3022971. Article.

Abraham Mendoza Andrade

Investigador Titular D, SNI Nivel I

Elías Olivares Benítez

SNI Nivel I

A HEURISTIC METHOD FOR THE SUPPLIER SELECTION AND ORDER QUANTITY ALLOCATION PROBLEM

ABSTRACT. This paper addresses the so-called supplier-selection and order-quantity allocation problem. Because of the complexity of this of problem (e.g., non-linear, discontinuous cost function), a new heuristic method is proposed and tested. This heuristic method explores the search space in a short period of time to find cheaper solutions. In order to test the efficiency of the proposed heuristic, two metaheuristic algorithms are applied: particle swarm optimization (PSO) and differential evolution (DE). Additionally, two numerical examples were solved. In the first one, it is shown that the proposed heuristic performed best compared to other solutions previously published in the literature, both in terms of computational time and total cost. The complexity analysis found that in the worst case, the proposed heuristic executes on average 99.9% less numerical operations than PSO and DE. In the second numerical example, larger instances were studied. Our findings show that the proposed heuristic was able to find a feasible solution in 15 out of 15 instances, while the PSO and the DE algorithms were unable to find a solution in 9 out of 15 instances. Therefore, the proposed heuristic does not just lead to lower total cost solutions, but it also performs a more exhaustive search in shorter computational times for larger instances of the problem. Finally, Wilcoxon and Kruskal-Wallis statistical tests demonstrate

significant difference between the proposed heuristic and the PSO and DE; the proposed heuristic presented a lower median in most cases. © 2020.

Alejo-Reyes A., Mendoza A., & Olivares-Benítez E. (2021). A heuristic method for the supplier selection and order quantity allocation problem. *Applied Mathematical Modelling*, 90, 1130-1142. doi: 10.1016/j.apm.2020.10.024. Article.

Abraham Mendoza Andrade

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CAR: HEURISTICS FOR THE INVENTORY ROUTING PROBLEM

ABSTRACT. Vendor managed inventory (VMI) is a streamlined approach to inventory and order fulfillment and is a system in which vendors continuously and automatically replenish a trading partner's inventory. Vendors must ensure appropriate quantities of storages at the point of demand and must ensure optimal distribution plans, including routing of the distribution vehicles. This problem is known as the inventory routing problem (IRP) and seeks to integrate the routing of vehicles used for collection and distribution, with conventional inventory management. This paper addresses an IRP with a manufacturer that supplies a product using a fleet of vehicles to a set of warehouses over a defined time horizon. We develop a mixed integer linear program to determine the optimal allocation and the routing schedule for warehouses over the defined time horizon. To solve this problem, we propose a three-phase heuristic approach, called CAR: clustering of receiver nodes, allocation of quantities to these nodes, and routing of delivery vehicles through clusters of nodes. Computational studies are carried out and experimental trials conducted over a large number of data sets provide encouraging results and show usefulness of the solution approaches. The proposed ILP would provide optimal solution to the problem but it demands huge computational effort. However, CAR2, a proposed heuristic, is able to get solutions 7.41% better than the upper bound solutions obtained from CPLEX. These approaches can easily be implemented into existing VMI systems. © 2020, Springer Science+Business Media, LLC, part of Springer Nature.

Nambirajan, R., Mendoza, A., Pazhani, S., Narendran, T. T., & Ganesh, K. (2020). CAR: heuristics for the inventory routing problem. *Wireless Networks*, 26(8): 5783-5808. doi: 10.1007/s11276-020-02259-6. Article.

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Jorge Eduardo Brievea Rico

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María de Lourdes Martínez Villaseñor

SNI Nivel I

Hiram Eredín Ponce Espinosa

Investigador Titular D, SNI Nivel I

A NON-CONTACT HEART RATE ESTIMATION METHOD USING VIDEO MAGNIFICATION AND NEURAL NETWORKS

ABSTRACT. Heart rate (HR) monitoring is a significant task in many medical, sports and aged care in assisted living applications, among other disciplines. In the literature, several works have reported effectiveness in addressing the measurement of HR using contact sensors such as adhesive or dry electro-conductive electrodes. However, there are several issues associated with contact sensors like portability problems, skin irritation, discomfort and body movement constraints. In this regard, this paper presents a non-contact HR estimation method using vision-based methods and neural networks. This work uses a bio-inspired Eulerian motion magnification approach to highlight the blood irrigation process of the cardiac pulse, which is later inputted to a feed-forward neural network trained to estimate the HR. For experimental analysis, we compare two magnification procedures, based on Gaussian and Hermite decomposition, over video recordings collected from the wrists of five subjects. Results show that the Hermite-based magnification method is robust under noise analysis (4.24 bpm of root mean squared-error in the worst case scenario). Furthermore, our results demonstrate that the Hermite-based method is competitive in the state-of-the-art (1.86 bpm in average of root mean squared-error) and can be implemented using a single camera for contactless HR estimation.

Moya-Albor, E., Brievea, J., Ponce, H., & Martínez-Villaseñor, L. (2020). A non-contact heart rate estimation method using video magnification and neural networks. *IEEE Instrumentation and Measurement Magazine*, 23(4), 56-62. doi: 10.1109/MIM.2020.9126072. Article.

Ernesto Moya Albor

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VISION-BASED AUTONOMOUS NAVIGATION WITH EVOLUTIONARY LEARNING

ABSTRACT. In this paper, we propose a vision-based autonomous robotics navigation system, it uses a bio-inspired optical flow approach using the Hermite transform and a fuzzy logic controller, the input membership functions were tuned applying a distributed evolutionary learning based on social wound treatment inspired in the Megaponera analis ant. The proposed method was implemented in a virtual robotics system using the V-REP software and in communication con MATLAB. The results show that the optimization of the input fuzzy membership functions improves the navigation behavior against an empirical tuning of them. © 2020, Springer Nature Switzerland AG.

Moya-Albor, E., Ponce, H., Brieva, J., Coronel, S. L., & Chávez-Domínguez, R. (2020). Vision-Based Autonomous Navigation with Evolutionary Learning. In Martínez-Villaseñor, L., Herrera-Alcántara, O., Ponce, H., Castro-Espinoza, F.A. (eds.), *Advances in Computational Intelligence. MICAI 2020. Lecture Notes in Computer Science*, vol. 12469 (pp. 459-471). Cham, Switzerland: Springer. doi: 10.1007/978-3-030-60887-3_39. Book Chapter.

Samuel Moisés Nucamendi Guillén

SNI Nivel C

Eduardo Díaz Medina

Profesor investigador

A NEW FORMULATION FOR THE CAPACITATED LOT SIZING PROBLEM WITH BATCH ORDERING ALLOWING SHORTAGES

ABSTRACT. This paper addresses the multi-product, multi-period capacitated lot sizing problem. In particular, this work determines the optimal lot size allowing for shortages (imposed by budget restrictions), but with a penalty cost. The developed models are well suited to the usually rather inflexible production resources found in retail industries. Two models are proposed based on mixed-integer formulations: (i) one that allows shortage and (ii) one that forces fulfilling the demand. Both models are implemented over test instances and a case study of a real industry. By investigating the properties of the obtained solutions, we can determine whether the shortage allowance will benefit the company.

The experimental results indicate that, for the test instances, the fact of allowing shortages produces savings up to 17% in comparison with the model without shortages, whereas concerning the current situation of the company, these savings represent 33% of the total costs while preserving the revenue. © 2020 by the authors.

Cardona-Valdés, Y., Nucamendi-Guillén, S., Peimbert-García, R. E., Macedo-Barragán, G., & Díaz-Medina, E. (2020). A new formulation for the capacitated lot sizing problem with batch ordering allowing shortages. *Mathematics*, 8(6). doi: 10.3390/MATH8060878. Article.

Samuel Moisés Nucamendi Guillén

SNI Nivel C

SYSTEMATIC REVIEW OF LITERATURE ON LEAN AND SIX SIGMA IN HEALTHCARE AND DIRECTIONS FOR FUTURE RESEARCH

ABSTRACT. Healthcare organizations have increasingly turned to Lean and Six Sigma (LSS) as management systems to achieve quality and efficiency in patient care. This study aims to classify this body of literature and to discover factors that enable and prevent successful LSS implementations. Peer-reviewed literature in journals that were published through 2018 in English language were sought through a search of multiple databases. The inclusion criterion was broad in that all areas of healthcare and interpretations of LSS were considered. The literature search yielded 368 publications. One third of the studies present a U.S. affiliation and only 19% has been conducted in developing countries. The case study is the most popular study type but only represents around 52% of the body of literature. Lean and the ED are preferred approach and setting, respectively. Factors that enable and prevent successful implementation were grouped by Managerial, Preparation, People, and Project relationships. There is a need for future literature to provide a longitudinal balanced view on the benefits and challenges of implementations, and for studies to follow experimental designs for statistical validity. This is the most inclusive review about LSS in healthcare as it includes different study types, healthcare settings and LSS tools together. © IEOM Society International.

Peimbert-García, R. E., Matis, T., Cuevas-Ortuño, J., & Nucamendi-Guillén, S. M. (2020). Systematic review of literature on lean and six sigma in healthcare and directions for future research. *Proceedings of the International Conference on Industrial Engineering and Operations Management*. 10th Annual International IEOM Conference (United Arab Emirates), Dubai (pp. 80-91). Conference Paper.

Samuel Moisés Nucamendi Guillén

SNI Nivel C

THE BI-OBJECTIVE MINIMUM LATENCY PROBLEM WITH PROFIT COLLECTION AND UNCERTAIN TRAVEL TIMES

ABSTRACT. This paper introduces a new bi-objective minimum latency problem with profit collection, where routes must be constructed in order to maximize the collected profit and to minimize the total latency. These objectives are usually conflicting. Thus, considering some important features, as the segmentation of the customers into two classes, mandatory and optional, and the presence of uncertain travel times, we follow a bi-objective approach, aiming to compute a set of Pareto-optimal alternatives with different trade-offs for a decision-maker to choose from. In order to address this computationally challenging problem, we propose a Multi-Objective Iterated Local Search. Computational results confirm the practicality of the algorithm, in terms of the quality of the solutions, and its computational efficiency in terms of time spent. We conclude that the algorithm finds good-quality solutions for small and medium-size instances. Copyright © 2020 by SCITEPRESS – Science and Technology Publications, Lda. All rights reserved.

Bruni, M. E., Khodaparasti, S., & Nucamendi-Guillén, S. (2020). The bi-objective minimum latency problem with profit collection and uncertain travel times. *ICORES 2020. 9th International Conference on Operations Research and Enterprise Systems* (Malta, Valletta (pp. 109-118). Conference Paper.

Samuel Moisés Nucamendi Guillén

SNI Nivel C

Elías Olivares Benítez

SNI Nivel I

THE MULTI-DEPOT OPEN LOCATION ROUTING PROBLEM WITH A HETEROGENEOUS FIXED FLEET

ABSTRACT. This paper introduces the multi-depot open location routing problem (MD-OLRP) with a heterogeneous fixed fleet. The problem is inspired by the collection problem of a company which collects raw materials from different suppliers coordinating several carriers. Each carrier has a heterogeneous fixed fleet. Moreover, there is a fixed cost for contracting each vehicle and a variable cost associated with the distance traveled. The empty haul return to the vehicles depot is not considered in the cost. The raw materials collected are delivered to a single delivery point. The problem is modeled as a Mixed Integer Linear Program (MILP) that minimizes the total cost, selecting the carriers to be

contracted, the vehicles to be used from each contracted carrier and the collection routes. For small instances, the model can be solved to optimality. However, approximate procedures are necessary to handle larger instances. In this sense, in the present work we propose an intelligent metaheuristic which incorporates problem specific knowledge to solve it. The computational results show that the solution method is computationally efficient and provides high quality solutions. In particular, the new solution obtained for the case of study generates savings of 30.86% to the company. The main contributions of the paper are the new problem statement that was not found in the literature, its association to the real problem of a company and the intelligent metaheuristic proposed to solve it. Additional experimentation used the model proposed to solve a simpler problem obtaining new best solutions compared to those reported in the recent literature. © 2020 Elsevier Ltd.

Nucamendi-Guillén, S., Gómez Padilla, A., Olivares-Benítez, E., & Moreno-Vega, J. M. (2020). The multi-depot open location routing problem with a heterogeneous fixed fleet. *Expert Systems with Applications*, 165(1). Article.

Elías Olivares Benítez

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Abraham Mendoza Andrade

Investigador Titular D, SNI Nivel I

Samuel Moisés Nucamendi Guillén

SNI Nivel C

A MEMETIC ALGORITHM FOR THE CUMULATIVE CAPACITATED VEHICLE ROUTING PROBLEM INCLUDING PRIORITY INDEXES

ABSTRACT. This paper studies the Cumulative Capacitated Vehicle Routing Problem, including Priority Indexes, a variant of the classical Capacitated Vehicle Routing Problem, which serves the customers according to a certain level of preference. This problem can be effectively implemented in commercial and public environments where customer service is essential, for instance, in the delivery of humanitarian aid or in waste collection systems. For this problem, we aim to minimize two objectives simultaneously, the total latency and the total tardiness of the system. A Mixed Integer formulation is developed and solved using the AUGMECON2 approach to obtain true efficient Pareto fronts. However, as expected, the use of commercial software was able to solve only small instances, up to 15 customers. Therefore, two versions of a Memetic Algorithm with Random Keys (MA-RK) were developed to solve the problem. The computational

results show that both algorithms provided good solutions, although the second version obtained denser and higher quality Pareto fronts. Later, both algorithms were used to solve larger instances (20-100 customers). The results were mixed in terms of quality but, in general, the MA-RK v2 consistently outperforms the first version. The models and algorithms proposed in this research provide useful insights for the decision-making process and can be applied to solve a wide variety of business situations where economic, customer service, environmental, and social concerns are involved.

Nucamendi-Guillén, S., Flores-Díaz, D., Olivares-Benítez, E., & Mendoza, A. (2020). A memetic algorithm for the cumulative capacitated vehicle routing problem including priority indexes. *Applied Sciences (Switzerland)*, 10(11). doi: 10.3390/app10113943. Article.

Elías Olivares Benítez

SNI Nivel I

Abraham Mendoza Andrade

Investigador Titular D, SNI Nivel I

AN IMPROVED GREY WOLF OPTIMIZER FOR A SUPPLIER SELECTION AND ORDER QUANTITY ALLOCATION PROBLEM

ABSTRACT. Supplier selection and order quantity allocation have a strong influence on a company's profitability and the total cost of finished products. From an optimization perspective, the processes of selecting the right suppliers and allocating orders are modeled through a cost function that considers different elements, such as the price of raw materials, ordering costs, and holding costs. Obtaining the optimal solution for these models represents a complex problem due to their discontinuity, non-linearity, and high multi-modality. Under such conditions, it is not possible to use classical optimization methods. On the other hand, metaheuristic schemes have been extensively employed as alternative optimization techniques to solve difficult problems. Among the metaheuristic computation algorithms, the Grey Wolf Optimization (GWO) algorithm corresponds to a relatively new technique based on the hunting behavior of wolves. Even though GWO allows obtaining satisfying results, its limited exploration reduces its performance significantly when it faces high multi-modal and discontinuous cost functions. In this paper, a modified version of the GWO scheme is introduced to solve the complex optimization problems of supplier selection and order quantity allocation. The improved GWO method called iGWO includes weighted factors and a displacement vector to promote the exploration of the search strategy, avoiding the use of unfeasible solutions. In order to evaluate its performance, the

proposed algorithm has been tested on a number of instances of a difficult problem found in the literature. The results show that the proposed algorithm not only obtains the optimal cost solutions, but also maintains a better search strategy, finding feasible solutions in all instances.

Alejo-Reyes, A., Cuevas, E., Rodríguez, A., Mendoza, A., & Olivares-Benítez, E. (2020). An improved grey wolf optimizer for a supplier selection and order quantity allocation problem. *Mathematics*, 8(9). doi: 10.3390/math8091457. Article.

Elías Olivares Benítez

SNI Nivel I

ATTRACTION-REJECTION MODEL FOR FACILITY LOCATION

ABSTRACT. Location of small and large stores requires a market study to determine the demand for a product in a particular region, as well as the selection of the target population. However, it is common to forget analyzing the impact of the competition regarding the suitability of locating facilities. The objective of this work is to propose a model that can be a tool to study the market; analyzing both demands as attraction factor and competition as rejection factor. The methodology used consists on the proposal of an exact model and a group of tests to prove its functionality. The model has characteristics that have not been considering before like a service radio where a new location can be open and is affected by customers and competitors. The results obtained demonstrated that the model suggests opening the facilities with fewer competitors and higher demand. This model is new because no other model considers how a new location is affected by competitors (rejection) and by customers (attraction), both located in a service radio area. © 2020 Instituto Politecnico Nacional. All rights reserved.

Cuevas, I. D. R., Flores, J. L. M., Benítez, E. O., Morales, S. O. C., & Partida, D. S. (2020). Attraction-rejection model for facility location. *Computación y Sistemas*, 24(1), 241-254. doi: 10.13053/CyS-24-1-3001. Article.

Elías Olivares Benítez

SNI Nivel I

HYBRID MODEL TO DESIGN A DISTRIBUTION NETWORK IN CONTRACT FARMING

[MODELO HÍBRIDO PARA DISEÑAR UNA RED DE DISTRIBUCIÓN EN LA AGRICULTURA POR CONTRATO]

ABSTRACT. This paper suggests a hybrid model to solve a distribution problem incorporating the impact of uncertainty in the solution. The model combines the deterministic approach and the simulation including stochastic variables such as harvest yield, loss risk and penalties/benefits to design a distribution network with the minimal cost. Through a case study that includes farmers, hubs and malt producers in the supplying chain of barley in Mexico, nine possible scenarios were analyzed to plan and distribute the harvested grain based on contract farming. This approach gets an optimal solution through an iterative process simulating the suggested solution by a mixed-integer linear programming model under uncertain conditions. The results show the convenience of maintaining the operation between four and five hubs depending on the possible scenario; besides, the variation of the levels of the barley producers' capacities are key elements in the planning to minimize the distribution cost throughout the suggested chain. © The author; licensee Universidad Nacional de Colombia.

Granillo-Macias, R., González-Hernández, I. J., Martínez-Flores, J. L., Caballero-Morales, S. O., & Olivares-Benítez, E. (2019). Hybrid model to design a distribution network in contract farming [Modelo híbrido para diseñar una red de distribución en la agricultura por contrato]. *DYNA (Colombia)*, 86(208), 102-109. doi: 10.15446/DYNA.V86N208.72056. Article.

Elías Olivares Benítez

SNI Nivel I

Abraham Mendoza Andrade

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INVENTORY REPLENISHMENT DECISION MODEL FOR THE SUPPLIER SELECTION PROBLEM USING METAHEURISTIC ALGORITHMS

ABSTRACT. In supply chain management, fast and accurate decisions in supplier selection and order quantity allocation have a strong influence on the company's profitability and the total cost of finished products. In this paper, a novel and non-linear model is proposed for solving the supplier selection and order quantity allocation problem. The model is introduced for minimizing the total cost per time

unit, considering ordering, purchasing, inventory, and transportation cost with freight rate discounts. Perfect rate and capacity constraints are also considered in the model. Since metaheuristic algorithms have been successfully applied in supplier selection, and due to the non-linearity of the proposed model, particle swarm optimization (PSO), genetic algorithm (GA), and differential evolution (DE), are implemented as optimizing solvers instead of analytical methods. The model is tested by solving a reference model using PSO, GA, and DE. The performance is evaluated by comparing the solution to the problem against other solutions reported in the literature. Experimental results prove the effectiveness of the proposed model, and demonstrate that metaheuristic algorithms can find lower-cost solutions in less time than analytical methods.

Alejo-Reyes, A., Olivares-Benítez, E., Mendoza, A., & Rodríguez, A. (2020). Inventory replenishment decision model for the supplier selection problem using metaheuristic algorithms. *Mathematical Biosciences and Engineering*, 17(3), 2016-2036. doi: 10.3934/mbe.2020107. Article.

Elías Olivares Benítez

SNI Nivel I

Juan Enrique Núñez Ríos

SNI Nivel C

Jacqueline Y. Sánchez García

SNI Nivel C

OPERATIONAL EFFICIENCY OF MEXICAN WATER UTILITIES: RESULTS OF A DOUBLE-BOOTSTRAP DATA ENVELOPMENT ANALYSIS

ABSTRACT. The objective of this paper is to estimate the operational efficiency of Mexican water utilities and identify the context variables that impact their efficiency. In particular, a bootstrap data envelopment analysis (DEA) and a bootstrap truncated regression analysis are combined in a two-stage research method. In the first stage, an input-oriented DEA model is used to determine bootstrap efficiency scores. Then, the corrected distribution function of the efficiency scores is used to estimate a truncated regression which is aimed to identify the significant influential context variables. Three categorical and two continuous context variables are considered in the analysis. Results show that only one context variable has a significant impact on the water utilities efficiency scores. Managerial recommendations are drawn from the analysis. It is suggested that water utilities continue or implement wastewater treatment, persist in decreasing and controlling leakage across the distribution network, and maximizing sewer coverage. © 2020 by the authors.

Ablanedo-Rosas, J. H., Campanur, A. G., Olivares-Benítez, E., Sánchez-García, J. Y., & Núñez-Ríos, J. E. (2020). Operational efficiency of Mexican water utilities: Results of a double-bootstrap data envelopment analysis. *Water (Switzerland)*, 12(2). doi: 10.3390/w12020553. Article.

Francisco Alejandro Orozco Argote

SNI Nivel I

Omar Guillermo Rojas Altamirano

Investigador Titular D, SNI Nivel I

A FIXED START SCHEDULING APPROACH FOR REPETITIVE CONSTRUCTION PROJECTS

ABSTRACT. In the face of the high variability in the completion of construction projects, the following research is generated. In the literature we can find several proposals to program projects, however, the variability of the activities causes high variability in the completion date of the projects. We hope that the proposed method, by controlling the start of activities, will ensure the completion date of the projects, by fixing the start of every activity with a high level of probabilistic confidence for the planned project duration. The proposed fixed start method (FSM) was tested in two case studies by using discrete event simulation. Project completion duration results were compared with the critical path method (CPM) and the program evaluation and review technique (PERT). Project completion was evaluated in the case studies by the coefficient of variance (COV), mean, and variance. The new method decreased the scheduled duration variability while meeting project completion times. © 2020, Korean Society of Civil Engineers.

Moreno, F., Orozco, F., Rojas, O., Senior, B., Poshdar, M., & Forcael, E. (2020). A Fixed Start Scheduling Approach for Repetitive Construction Projects. *KSCE Journal of Civil Engineering*, 24(6), 1671-1682. doi: 10.1007/s12205-020-1429-8. Article.

Josué Ortiz Medina

SNI Nivel I

ENHANCED DESALINATION PERFORMANCE IN COMPACTED CARBON-BASED REVERSE OSMOSIS MEMBRANES

ABSTRACT. Reverse osmosis membranes typically suffer compaction during the initial stabilization stage due to the applied hydraulic pressure, altering the desalination performance. The elucidation of the underlying transformations during compaction is key for further development of new membranes and its deployment in real-world scenarios. Hydraulic compaction of amorphous carbon (a-C) based membranes under cross-flow operation for water purification and desalination has been observed

experimentally, and analysed employing molecular dynamics simulations. The previous outstanding separation performance for carbon membranes, especially for the nitrogen-containing (a-C:N) type, has been studied during compaction using lab-scale cross-flow desalination membrane systems. Our results indicate that the high-water pressure induces an overall reduction in the interstitial spaces within the a-C structure. Remarkably, the compacted a-C:N membrane exhibits improved performance in salt rejection and water permeability, compared to the a-C based membrane. Our analysis shows that performance improvement can be related to the higher mechanical stability of the carbon structure due to the presence of nitrogen sites, which also promote water diffusion and permeability. These results show that a-C:N based membranes are a feasible alternative to conventional polymeric membranes. © The Royal Society of Chemistry.

Kitano, H., Takeuchi, K., Ortiz-Medina, J., Ito, I., Morelos-Gómez, A., Cruz-Silva, R., Yokokawa, T., Terrones, M., Yamaguchi, A., Hayashi, T., & Endo, M. (2020). Enhanced desalination performance in compacted carbon-based reverse osmosis membranes. *Nanoscale Advances*, 2(8), 3444-3451. doi: 10.1039/d0na00263a. Article.

Josué Ortiz Medina

SNI Nivel I

FACILE SYNTHESIS OF GRAPHENE SHEETS INTERCALATED BY CARBON SPHERES FOR HIGH-PERFORMANCE SUPERCAPACITOR ELECTRODES

ABSTRACT. The composites consisting of graphene oxides (GOs) and carbon spheres (CSs), which were hydrothermally derived from the aqueous solution of glucose with average diameter of 200 nm, were mechanically mixed, and the GOs/CSs (GCSs) were thermally treated at high temperatures in the range of 700–900 °C. In the GCS composites, the CSs as spacers located between the GO sheets prevent the aggregation and restacking of graphene sheets. The GCS composites (GO/CS = 1) treated at 800 °C (GCS@800) have the high specific capacitances of 272.8 and 197.5 F g⁻¹ in a three-electrode cell at the current density of 0.2 and 10 A g⁻¹, respectively, in 6 M KOH aqueous solution, and demonstrated high rate capability and good cycling stability. The excellent electrochemical performance of the GCS@800 electrode is attributed to its structure with hierarchical porous structures including overwhelming micropores and a few of macropores. This work provides an effective and simple technique by integrating CSs and graphene sheets into composite structures for high-performance energy storage devices. © 2020 Elsevier Ltd.

Wang, Z., Li, Y., Liu, J., Gui, T., Ogata, H., Gong, W., Vipin, A. K., Wang, Y., Hong Melvin, G. J., Ortiz-Medina, J.,

Wang, S., Cruz-Silva, R., Morimoto, S., Hashimoto, Y., Fugetsu, B., Sakata, I., Terrones, M., & Endo, M. (2020). Facile synthesis of graphene sheets intercalated by carbon spheres for high-performance supercapacitor electrodes. *Carbon*, 167(15), 11-18. doi: 10.1016/j.carbon.2020.04.100. Article.

Karina Ruby Pérez Daniel

Profesor investigador

ROTTEN FRUIT DETECTION USING A ONE STAGE OBJECT DETECTOR

ABSTRACT. Digital images and computer sciences have become two powerful tools in several areas, such as astronomy, medicine, forensics, etc. In the last years, computer sciences are getting involved in agricultural and food science to decide based on estimated or actual parameters named features. Rottenness is the state of decomposing or decaying the quality of the fruit, which not only affects the taste and appearance but also modifies its nutritional composition, causing the presence of mycotoxins dangerous for humans. Nowadays, rottenness detection is carried out using human inspection or using Ultraviolet light to highlight spots of rottenness represented as fluorescence. Recent computer vision approaches address this problem using hyperspectral imaging systems. In this paper, we propose to use a one-stage object detector inspired by RetinaNet to detect whether a fruit is fresh or rotten. One of the main stages of RetinaNet is based on computing a multi-scale convolutional feature pyramid network on top of a backbone. Therefore, in this work, we analyze the performance of RetinaNet using different artificial neural networks as backbone to determine the highest accuracy for fruit and rottenness detection. The experiments were done using a dataset composed of 13599 images divided by 6 classes, 3 fresh fruits, and 3 rotten fruits. The performance evaluation considers the mean average precision in the detection and the inference time of tested backbone models. © 2020, Springer Nature Switzerland AG.

Pérez-Daniel, K., Fierro-Radilla, A., & Peñaloza-Cobos, J. P. (2020). Rotten Fruit Detection Using a One Stage Object Detector. In Martínez-Villaseñor, L., Herrera-Alcántara, O., Ponce, H., Castro-Espinoza, F.A. (eds.), *Advances in Computational Intelligence. 19th Mexican International Conference on Artificial Intelligence, MICAI 2020, Mexico City, Mexico, October 12–17, 2020, Proceedings, Part II* (pp. 325-336). Cham, Switzerland: Springer. doi: 10.1007/978-3-030-60887-3_29. Book Chapter.

Karina Ruby Pérez Daniel

Profesor investigador

SIAMESE CONVOLUTIONAL NEURAL NETWORK FOR ASL ALPHABET RECOGNITION

ABSTRACT. American sign language is an important communication way to convey information among the deaf community in North America and is primarily used by people who have hearing or speech impairments. The deaf community faces a struggle in schools and other institutions because they usually consist primarily of hearing people. Besides, deaf people often feel misunderstood by people who do not know sign language, for example, family members. In the last two decades, researchers have been proposing automatic sign language recognition systems to facilitate the learning of sign language, and nowadays, computer scientists have focused on using artificial intelligence in order to develop a system capable of reducing the communication gap between hearing and deaf people. In this paper, it is proposed a Siamese convolutional neural network for American sign language alphabet recognition. This siamese architecture allows the computer to reduce the high interclass similarity and high intraclass variations. The results show that the proposed method outperforms the state-of-the-art systems. © 2020 Instituto Politécnico Nacional. All rights reserved.

Radilla A. N. F., & Daniel K. R. P. (2020). Siamese convolutional neural network for ASL alphabet recognition. *Computación y Sistemas*, 24(3), 1211-1218. doi: 10.13053/CYS-24-3-3481. Article.

Karina Ruby Pérez Daniel

Profesor investigador

WATERMARKING OF HDR IMAGES IN THE SPATIAL DOMAIN WITH HVS-IMPERCEPTIBILITY

ABSTRACT. This paper presents a watermarking method in the spatial domain with HVS-imperceptibility for High Dynamic Range (HDR) images. The proposed method combines the content readability afforded by invisible watermarking with the visual ownership identification afforded by visible watermarking. The HVS-imperceptibility is guaranteed thanks to a Luma Variation Tolerance (LVT) curve, which is associated with the transfer function (TF) used for HDR encoding and provides the information needed to embed an imperceptible watermark in the spatial domain. The LVT curve is based on the inaccuracies between the non-linear digital representation of the linear luminance acquired by an HDR sensor and the brightness perceived by the Human Visual System (HVS) from the linear lumi-

nance displayed on an HDR screen. The embedded watermarks remain imperceptible to the HVS as long as the TF is not altered or the normal calibration and colorimetry conditions of the HDR screen remain unchanged. Extensive qualitative and quantitative evaluations on several HDR images encoded by two widely-used TFs confirm the strong HVS-imperceptibility capabilities of the method, as well as the robustness of the embedded watermarks to tone mapping, lossy compression, and common signal processing operations. © 2013 IEEE.

Pérez-Daniel K. R., García-Ugalde F., & Sánchez V. (2020). Watermarking of HDR images in the spatial domain with HVS-Imperceptibility. *IEEE Access*, 8(2020), 156801-156817. doi: 10.1109/ACCESS.2020.3019517. Article.

Claudio de Jesús Pita Ruíz Velasco

SNI Nivel I

POLY-CAUCHY NUMBERS WITH LEVEL 2

ABSTRACT. We introduce poly-Cauchy numbers with level 2. Poly-Cauchy numbers may be interpreted as a kind of generalizations of the classical Cauchy numbers by using the inverse relation of exponentials and logarithms. On the contrary, poly-Bernoulli numbers can be from the inverse relation of logarithms and exponentials. In this similar stream, poly-Cauchy numbers with level 2 may be yielded from the inverse relation about the hyperbolic sine function, which is a 2-step function of the exponential function. In this article, we show several expressions, relations, and properties about poly-Cauchy numbers with level 2. Poly-Cauchy numbers with level 2 can be expressed in terms of multinomial coefficients with combinatorial summation, Stirling numbers of the first kind, or iterated integrals. We also give some recurrence relations for poly-Cauchy numbers with level 2. When the index is negative, the double summation may be formulated as a closed form. A simple case of Cauchy numbers with level 2 has some more relations with D numbers from higher-order Bernoulli numbers or complementary Euler numbers. We prove some more expressions in determinants, continued fractions or by Trudi's formula. © 2020, © 2020 Informa UK Limited, trading as Taylor & Francis Group.

Komatsu, T., & Pita-Ruiz, C. (2020). Poly-Cauchy numbers with level 2. *Integral Transforms and Special Functions* 31(7), 570-585. doi: 10.1080/10652469.2019.1710745. Article.

Claudio de Jesús Pita Ruíz Velasco

SNI Nivel I

SHIFTED CAUCHY NUMBERS

ABSTRACT. We introduce and study shifted Cauchy numbers as different natural extension of the classical Cauchy numbers, in particular, in terms of determinantal expressions. We give several arithmetical or combinatorial properties. We also show a determinant expression of Cauchy numbers of the second kind extensively.

Komatsu T., & Pita-Ruiz C. (2020). Shifted Cauchy numbers. *Quaestiones Mathematicae*, 43(2), 213-226. doi: 10.2989/16073606.2018.1546775. Article.

Hiram Eredín Ponce Espinosa

Investigador Titular D, SNI Nivel I

María de Lourdes Martínez Villaseñor

SNI Nivel I

A 2020 PERSPECTIVE ON "A NOVEL METHODOLOGY FOR OPTIMIZING DISPLAY ADVERTISING CAMPAIGNS USING GENETIC ALGORITHMS"

ABSTRACT. Online advertising has become the most important area of publicity. From a post-2020 perspective, we identify three trends in online advertising comprising: the rapid evolution of online advertising mainly over mobile networks, how to cope with big companies leading digital marketing, and the exploration of new methods to handle the dynamics of the e-commerce ecosystem. We proposed a new methodology for online advertising in small ad networks using supervised machine learning and metaheuristic methods. Our research will be beneficial for addressing the above-mentioned trends in online advertising focusing on small ad networks. It contributes to the establishment of an information system technology and practice within the scope of the development of marketing business strategies in e-commerce. Currently, we are exploring how to improve the flexibility of our approach to make it easier to adapt to new ad campaigns, analyzing and comparing different computational methods, and how to increase the performance of presenting custom ads to users when dealing with small data sets. Online advertising in small ad networks will be very useful in the following years. Hence, there are still many challenges to be dealt with in order to implement it in the business strategies of the new digital marketing. © 2020 Elsevier B.V.

Miralles-Pechuán, L., Ponce, H., & Martínez-Villaseñor, L. (2020). A 2020 perspective on "A novel methodology for optimizing display advertising campaigns using genetic algorithms". *Electronic Commerce Research and Applications* 40. doi: 10.1016/j.elerap.2020.100953. Article.

Hiram Eredín Ponce Espinosa

Investigador Titular D, SNI Nivel I

A COMPARATIVE ANALYSIS OF EVOLUTIONARY LEARNING IN ARTIFICIAL HYDROCARBON NETWORKS

ABSTRACT. Artificial hydrocarbon networks (AHN) is a supervised learning model that is loosely inspired on the interactions of molecules in organic compounds. This method is able to model data in a hierarchical and robust way. However, the original training algorithm is very time-consuming. Recently, novel training algorithms have been applied, including evolutionary learning. Particularly, this training algorithm employed particle swarm optimization (PSO), as part of the procedure. In this paper, we present a benchmark of other meta-heuristic optimization algorithms implemented on the training method for AHN. In this study, PSO, harmony search algorithm, cuckoo search, grey wolf optimization and whale optimization algorithm, were tested. The experimental results were done using public data sets on regression and binary classification problems. From the results, we concluded that the best algorithm was cuckoo search optimization for regression problems, while there is no evidence that one of the algorithms performed better for binary classification problems. © 2020, Springer Nature Switzerland AG.

Ponce, H. & Souza P. (2020). A Comparative Analysis of Evolutionary Learning in Artificial Hydrocarbon Networks. In Martínez-Villaseñor, L., Herrera-Alcántara, O., Ponce, H., & Castro-Espinoza F. A. (eds.), *Advances in Soft Computing. 19th Mexican International Conference on Artificial Intelligence, MICAI 2020. Lecture Notes in Computer Science*, vol 12468. (pp. 223-234). Cham, Switzerland: Springer. doi: 10.1007/978-3-030-60884-2_17. Book Chapter.

Hiram Eredín Ponce Espinosa

Investigador Titular D, SNI Nivel I

María de Lourdes Martínez Villaseñor

SNI Nivel I

APPROACHING FALL CLASSIFICATION USING THE UP-FALL DETECTION DATASET: ANALYSIS AND RESULTS FROM AN INTERNATIONAL COMPETITION

ABSTRACT. This chapter presents the results of the Challenge UP – Multimodal Fall Detection competition that was held during the 2019 International Joint Conference on Neural Networks (IJCNN 2019). This competition lies on the fall classification problem, and it aims to classify eleven human activities (i.e. five types of falls and six simple daily activities) using the joint information from different wearables, ambient sensors and video recordings,

stored in a given dataset. After five months of competition, three winners and one honorific mention were awarded during the conference event. The machine learning model from the first place scored 82.47% in F1-score, outperforming the baseline of 70.44%. After analyzing the implementations from the participants, we summarized the insights and trends of fall classification. © 2020, Springer Nature Switzerland AG.

Ponce, H., & Martínez-Villaseñor, L. (2020). Approaching Fall Classification Using the UP-Fall Detection Dataset: Analysis and Results from an International Competition. In Kacprzyk, J. (ed.), *Studies in Systems, Decision and Control*, vol. 273 (pp. 121-133). Cham, Switzerland: Springer. doi: 10.1007/978-3-030-38748-8_6. Book Chapter.

Hiram Eredín Ponce Espinosa

Investigador Titular D, SNI Nivel I

DESIGNING A ROBUST CONTROLLER USING SMC AND FUZZY ARTIFICIAL ORGANIC NETWORKS FOR BRUSHED DC MOTORS

ABSTRACT. Electric direct-current (DC) drives based on DC motor are extremely important in the manufacturing process, so it must be crucial to increase their performance when they are working on load disturbances or the DC motor's parameters change. Usually, several load torque suddenly appears when electric drives are operating in a speed closed-loop, so robust controllers are required to keep the speed high-performance. One of the most well-known robust strategies is the sliding mode controller (SMC), which works under discontinuous operation. This controller can handle disturbances and variations in the plant's parameters, so the controller has robust performance. Nevertheless, it has some disadvantages (chattering). Therefore, this paper proposed a fuzzy logic controller (FLC) that includes an artificial organic network for adjusting the command signal of the SMC. The proposed controller gives a smooth signal that decrements the chattering in the SMC. The stability condition that is based on Lyapunov of the DC motor is driven is evaluated; besides, the stability margins are calculated. The proposed controller is designed using co-simulation and a real testbed since co-simulation is an extremely useful tool in academia and industry allows to move from co-simulation to real implementation in short period of time. Moreover, there are several universities and industries that adopt co-simulation as the main step to design prototypes. Thus, engineering students and designers are able to achieve excellent results when they design rapid and functional prototypes. For instance, co-simulation based on Multisim leads to design directly printed circuit boards so engineering students or designers could swiftly get an experimental DC drive. The experimental results using this platform show excellent DC-drive

performance when the load torque disturbances are suddenly applied to the system. As a result, the proposed controller based on fuzzy artificial organic and SMC allows for adjusting the command signal that improves the dynamic response in DC drives. The experimental response using the sliding-mode controller with fuzzy artificial organic networks is compared against an auto-tuning, Proportional-Integral-Derivative (PID), which is a conventional controller. The PID controller is the most implemented controller in several industries, so this proposal can contribute to improving manufacturing applications, such as micro-computer numerical control (CNC) machines. Moreover, the proposed robust controller achieves a superior-speed response under the whole tested scenarios. Finally, the presented design methodology based on co-simulation could be used by universities and industry for validating and implementing advanced control systems in DC drives.

Ponce, P., Rosales, J. A., Molina, A., Ponce, H., & MacCleery, B. (2020). Designing a Robust Controller Using SMC and Fuzzy Artificial Organic Networks for Brushed DC Motors. *Energies*, 13, 121-133. doi: 10.1007/978-3-030-83748-8_6. Article.

Hiram Eredín Ponce Espinosa

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SNI Nivel I

DISTRIBUTED EVOLUTIONARY LEARNING CONTROL FOR MOBILE ROBOT NAVIGATION BASED ON VIRTUAL AND PHYSICAL AGENTS

ABSTRACT. This paper presents a distributed evolutionary learning control based on social wound treatment for mobile robot navigation using an integrated multi-robot system comprised of simulated and physical robots. To do so, this work proposes an extension of the population-based metaheuristic wound treatment optimization (WTO) method into a distributed scheme. In addition, this distributed WTO method is implemented on the multi-robot system allowing them to experience the environment in their own and communicate their findings, resulting in an emergence intelligence. We implemented our proposal using the combination of five simulated robots with one physical robot for tuning a navigation controller to move freely in a workspace. Results showed that the solution found by this multi-robot system aims using the output controller in the physical robot for successfully achieving the

goal to move the robot around a U-maze, without applying any transfer learning approach. We consider this proposal useful in evolutionary robotics, and of great importance to decrease the gap related to transfer knowledge in robotics from simulation to reality. © 2019 Elsevier B.V.

Ponce, H., Moya-Albor, E., Martínez-Villaseñor, L., & Brieva, J. (2019). Distributed evolutionary learning control for mobile robot navigation based on virtual and physical agents. *Simulation Modelling Practice and Theory*, 102. doi: 10.1016/j.simpat.2019.102058. Article.

Hiram Eredín Ponce Espinosa

Investigador Titular D, SNI Nivel I

EVOLVING FUZZY NEURAL HYDROCARBON NETWORKS: A MODEL BASED ON ORGANIC COMPOUNDS

ABSTRACT. This paper presents a new evolving intelligent model capable of combining the techniques and concepts of artificial neural networks, fuzzy systems and artificial hydrocarbon networks, in which the latter aggregates concepts of organic chemistry to carry out the training of intelligent models. The proposed model has three layers where the first two form a fuzzy inference system and the third layer is responsible for the defuzzification process through concepts based on the bond between carbons and hydrogens. The fuzzification process of the model is based on the techniques of an autonomous data partitioning algorithm that can elicit the number and centers of the clouds that make up the fuzzy neurons in the first layer of the model. Thereby, an evolving algorithm is employed, which uses the data set as a stream in a single-pass incremental mode (allowing fast processing). This is achieved in an unsupervised manner, and thus, to eliminate possible overfitting problems in the subsequent supervised training process, a Bayesian pruning technique is used to identify the neurons that are finally most relevant to the actual supervised approximation and/or classification problem. To validate the proposed approach, binary pattern classification tests, multi-class classification problems and regression problems were performed. The results obtained and compared with other intelligent models in the literature prove that the approach becomes a model capable of extracting knowledge from data sets and using concepts of organic chemistry to perform learning tasks with high degree of reliability. © 2020 Elsevier B.V.

Souza, P., Ponce, H., & Lughofer, E. (2020). Evolving fuzzy neural hydrocarbon networks: A model based on organic compounds. *Knowledge-Based Systems*, 203. doi: 10.1016/j.knosys.2020.106099. Article.

Hiram Eredín Ponce Espinosa

Investigador Titular D, SNI Nivel I

IMPLEMENTATION OF A SVM ON AN EMBEDDED SYSTEM: A CASE STUDY ON FALL DETECTION

ABSTRACT. Edge Computing seeks to bring Machine Learning as close as possible to the source events of interest, providing an almost instant interpretation to data acquired by sensors giving sense to raw data while addressing concerns of particular applications such as latency, privacy and server stress relieve. Due to a lack of research on this particular type of application, we are faced with difficulties both in software and hardware as embedded systems are known to possess serious limitations on its available processing resources. To address this, we make use of the concepts of edge computing and offline programming to accomplish a reliable machine learning model deployment on the microprocessor. By studying real case problem, we can get measurements on the resources required by such an application as well as its performance. In this study, we address the implementation of such an application in an embedded system focusing on the detection of human falls. © 2020, Springer Nature Switzerland AG.

Marquez-Ordaz L., & Ponce H. (2020). Implementation of a SVM on an Embedded System: A Case Study on Fall Detection. In Martínez-Villaseñor, L., Herrera-Alcántara, O., Ponce, H., Castro-Espinoza, F.A. (eds.), *Advances in Soft Computing. 19th Mexican International Conference on Artificial Intelligence, MICAI 2020. Lecture Notes in Computer Science*, vol 12468 (pp. 76-87). Cham, Switzerland: Springer. doi: 10.1007/978-3-030-60884-2_6. Conference Paper.

Hiram Eredín Ponce Espinosa

Investigador Titular D, SNI Nivel I

POPULATION-BASED METAHEURISTIC OPTIMIZATION USING ORGANIZED SOCIAL WOUND TREATMENT

ABSTRACT. This paper introduces a new strategy by means of the social wound treatment for improving optimization in population-based metaheuristic methods. This strategy is inspired on the behavior observed in social animals when dealing with injuries at both social and individual levels. An implementation of this strategy is done in the so-called wound treatment optimization (WTO) algorithm. A benchmark on several test functions for optimization was conducted to compare the response between the simple particle swarm optimization (PSO) and the WTO. Also, an application of WTO in decentralized system of robots was developed aiming to learn suitable parameters in the navigation controller of robots. This is the first time that social wound treat-

ment is considered in these optimization methods. © 2019 IEEE.

Ponce, H. (2019). Population-Based Metaheuristic Optimization Using Organized Social Wound Treatment. 2019 IEEE. 2019 IEEE 14th International Symposium on Autonomous Decentralized Systems (ISADS) (Netherlands), Utrecht. doi: 10.1109/ISADS45777.2019.9155552. Conference Paper.

Hiram Eredín Ponce Espinosa

Investigador Titular D, SNI Nivel I

TOWARDS ARTIFICIAL HYDROCARBON NETWORKS: THE CHEMICAL NATURE OF DATA-DRIVEN APPROACHES

ABSTRACT. Inspiration in nature has been widely explored, from macro to micro-scale. Natural phenomena mainly considers adaptability, optimization, robustness, organization, among other properties, to deal with complexity. When looking into chemical phenomena, stability and organization are two properties that emerge. Recently, artificial hydrocarbon networks (AHN), a supervised learning method inspired in the inner structures and mechanisms of chemical compounds, have been proposed as a data-driven approach in artificial intelligence. AHN have been successfully applied in data-driven approaches, such as: regression and classification models, control systems, signal processing, and robotics. To do so, molecules-the basic units of information in AHN-play an important role in the stability, organization and interpretability of this method. Until now, building the architecture of AHN has been treated as a whole entity; but distributed computing mechanisms, as well as the exploitation of hierarchical organization of molecules, can enhance the performance of AHN. Thus, this paper aims to discuss challenges and trends of artificial hydrocarbon networks as a data-driven method, with emphasis on packaging, distributed computing and hierarchical properties. Throughout this work, it presents a description of the main insights of AHN and the proposed distributed and hierarchical mechanisms in molecules. Potential applications and future trends on AHN are also discussed. © 2019 IEEE.

Ponce, H. (2019). Towards Artificial Hydrocarbon Networks: The Chemical Nature of Data-Driven Approaches. 2019 IEEE. 2019 IEEE 14th International Symposium on Autonomous Decentralized Systems (ISADS) (Netherlands), Utrecht. doi: 10.1109/ISADS45777.2019.9155892. Conference Paper.

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MONITORING IMPROVEMENT ON REACTIVE, PROACTIVE AND HYBRID PROTOCOLS OF WIRELESS SENSOR NETWORKS

ABSTRACT. Wireless Sensor Networks (WSNs) base their performance on the routing protocol, which is in charge of managing information and making the network as resilient as possible. This work is based on performance metrics comparisons of three types of protocols (reactive, proactive and hybrid). In order to analyze wireless networks behavior and energy performance, simulations and real scenarios are ran on a university campus in Guadalupe, Mexico. The environment recreates the necessary conditions to evaluate and extrapolate the characteristics of a Smart Campus. With the implemented methodology, we can understand which performance metrics are impacting directly in a greater or lesser extent on three examples of well-known routing protocols. It is concluded that the hybrid protocol has 10% better performance than the others because it has the appropriate complexity and design to manage the packets under parameters such as: Route validity and response time, overhead, packet re-transmissions, complexity, delay, resilience and energy. The simulation tool has an accuracy of 93 %, similar to the results thrown in a real environment where sensors are dispersed in 300 square meters of the campus. © 2019 IEEE.

Del-Valle-Soto, C., Velázquez, R., Gutiérrez, C. A., Valdivia, L. J., & Del Puerto-Flores, J. A. (2019). Monitoring Improvement on Reactive, Proactive and Hybrid Protocols of Wireless Sensor Networks. 2019 IEEE. 2019 IEEE 39th Central America and Panama Convention (CONCAPAN XXXIX) (Guatemala), Guatemala City. doi: 10.1109/CONCAPANXXXIX47272.2019.8977041. Conference Paper.

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SNI Nivel I

PERFORMANCE OF MRC DETECTION IN OFDM SYSTEM WITH VIRTUAL CARRIERS OVER V2V CHANNELS

ABSTRACT. The vehicle-to-vehicle (V2V) communications require to transmit over doubly selective channels (DSC) with high intercarrier interference (ICI). These characteristics degrade the performance significantly in terms of bit error rate (BER) of orthogonal frequency division multiplexing (OFDM) systems. State-of-the-art solutions involve receivers with high computational complexity or a reduced system spectral efficiency. This paper investigates the BER performance of OFDM system with virtual carriers (VC) employing the maximal ratio combining (MRC)-based low-complexity detector. The results obtained show that the use of VC provides diversity in the data received, which allows to obtain a gain of ≥ 5 dB compared to the OFDM system with linear/non-linear detector. In addition, the proposed detector has linear complexity, which makes it an attractive solution for the implementation of real-time vehicular systems. © 2019 IEEE.

Del Puerto-Flores, J. A., Cortés, J., Gutiérrez, C. A., Del Valle-Soto, C., Velázquez, R., & Valdivia, L. J. (2019). Performance of MRC Detection in OFDM System with Virtual Carriers over V2V Channels. 2019 IEEE. 39th Central America and Panama Convention (CONCAPAN XXXIX) (Guatemala), Guatemala City. doi: 10.1109/CONCAPANXXXIX47272.2019.8976929. Conference Paper.

María José Quintana Hernández
SNI Nivel I

MICROSTRUCTURE CHARACTERIZATION AND MECHANICAL PROPERTIES IN INDIVIDUAL ZONES OF LINEAR FRICTION WELDED TI-6AL-4V ALLOY

ABSTRACT. Linear friction welding (LFW) offers a new approach to manufacture aerospace components while improving the buy-to-fly ratio. However, the fundamental knowledge associated with the LFW process, including the attendant microstructural evolution and corresponding mechanical behavior is still rather limited. In this research effort, subscale tensile coupons were prepared and tested

to determine the properties of each discrete zone of the linear friction welded specimen, namely the welded zone, thermomechanically affected zone, and parent material. The results show that the yield strength of the welded zone is 20 pct higher than the parent material and the thermomechanically affected zone is 13 pct higher than the parent material. Materials characterization, including optical microscopy, scanning electron microscopy, electron backscattered diffraction-based orientation microscopy and transmission electron microscopy, was conducted to develop an understanding of the microstructure-property relationships. The highly refined nature of the microstructure makes final interpretations challenging, but the evidence suggests that the mechanical behavior is dominated by phenomenon that operate at the 1 to 50 nm length scale, including strain hardening and highly refined features that hinder slip. © 2020, The Minerals, Metals & Materials Society and ASM International.

Mendoza, M. Y., Quintana, M. J., & Collins, P. C. (2020). Microstructure Characterization and Mechanical Properties in Individual Zones of Linear Friction Welded Ti-6Al-4V Alloy. *Metallurgical and Materials Transactions A: Physical Metallurgy and Materials Science*, 51(12), 6294-6306. doi: 10.1007/s11661-020-06043-1. Article.

María José Quintana Hernández

SNI Nivel I

TEXTURE ANALYSIS OF ADDITIVELY MANUFACTURED Ti-6Al-4V DEPOSITED USING DIFFERENT SCANNING STRATEGIES

ABSTRACT. A limited number of features that comprise the more wholistic materials state of electron beam, powder bed additively manufactured Ti-6Al-4V have been investigated. Coupling scanning electron microscopy and orientation microscopy, the microstructure and texture of samples produced using different AM scan strategies have been studied at various positions along the build height of the samples. Both the qualitative and quantitative results, including parent beta grain orientation, alpha lath texture, and predominant type of microstructure (colony vs basketweave), and their length scales are included. Both the scan strategy used for the build and the time between proximal molten pool passes have been shown to significantly influence the resulting microstructure and texture. © 2020, The Minerals, Metals & Materials Society and ASM International.

Quintana, M. J., Kenney, M. J., Agrawal, P., & Collins, P. C. (2020). Texture Analysis of Additively Manufactured Ti-6Al-4V Deposited Using Different Scanning Strategies. *Metallurgical and Materials Transactions A: Physical Metallurgy and Materials Science*, 51(12), 6574-6583. doi: 10.1007/s11661-020-06040-4. Article.

Héctor Robles Campos

Profesor investigador

A CONTROL SCHEME IN THE DQ REFERENCE FRAME FOR HEXVERTER-BASED SYSTEMS

ABSTRACT. A control approach developed in the $\alpha\beta$ reference frame must be able to track control signals which are sinusoidal functions of time. Therefore, designing these compensators is not a straightforward task. Alternatively, a control scheme elaborated in dq reference frame offers the possibility to track dc control signals. It also allows the design of compensators with simpler structures and low dynamic orders. The purpose of this work is to propose a control scheme in the dq reference frame for Hexverter-based systems. Considering the Hexverter's operating principle and its characteristic waveforms, a frequency decoupled branch current control model in the dq reference frame is synthesized. It can be considered as an extension of the control model developed for the two-level voltage source inverter. A feature of the proposed control is to allow independent regulation of the Hexverter's active and reactive power flows. The former control is then integrated to a modulator and a voltage balancing algorithm when the Hexverter-based system is functioning as an intertie. The effectiveness of the characterized system is validated via a detailed PSCAD/EMTDC computer simulation. © 2019 IEEE.

Robles-Campos, H. R. & Mancilla-David, F. (2019). A control scheme in the dq reference frame for Hexverter-based systems. 2019 IEEE. 51th North American Power Symposium (NAPS) (United States), Wichita. doi: 10.1109/NAPS46351.2019.9000248. Conference Paper.

Héctor Robles Campos

Profesor investigador

Julio César Rosas Caro

SNI Nivel I

NUMERICAL OPTIMIZATION OF SWITCHING RIPPLES IN THE DOUBLE DUAL BOOST CONVERTER THROUGH THE EVOLUTIONARY ALGORITHM L-SHADE

ABSTRACT. Power-electronics based converters are essential circuits in renewable energy applications such as electricity generated with photovoltaic panels. The research on the field is getting increasing attention due to climate change problems and their possible attenuation with the use of renewable energy. Mathematical models of the converters are being used to optimize several aspects of their operation. This article is dedicated to optimizing (through the mathematical model and an evolutionary algorithm) the operation of a state-of-the-art converter. The converter, which is composed of two parts or

phases, is controlled by pulse width modulation with two switching signals (one for each phase). The converter provides by itself low switching ripple in both the output voltage and the input current, which is beneficial for renewable energy applications. In the traditional operation, one of the switching signals has an algebraic dependence on the other one. This article proposes a new way to select the duty cycle for both signals. In the proposed method, duty cycles of both phases are considered independent of each other; this provides an extra degree of freedom; on the other hand, this produce that the possible combinations of duty cycles which produce a certain voltage gain is infinite, it becomes a problem with infinite possible solutions. The proposed method utilizes the a linear success-history based adaptive differential evolution with linear population reduction, also called L-SHADE algorithm for simplicity, to find the two duty cycles that achieve the desired voltage gain and to minimize the converters switching ripple. The obtained results are compared with the former operation of the converter; the proposed operation achieves a lower output voltage ripple while achieving the desired operation (voltage gain). © 2020 by the authors. Licensee MDPI, Basel, Switzerland.

Rodríguez, A., Alejo-Reyes, A., Cuevas, E., Robles-Campos, H. R., & Rosas-Caro, J. C. (2020). Numerical optimization of switching ripples in the double dual boost converter through the evolutionary algorithm l-shade. *Mathematics*, 8(11), 1-19. doi: 10.3390/math811911. Article.

Rodrigo Romero Silva

SNI Nivel I

SHOP-FLOOR SCHEDULING AS A COMPETITIVE ADVANTAGE: A STUDY ON THE RELEVANCE OF CYBER-PHYSICAL SYSTEMS IN DIFFERENT MANUFACTURING CONTEXTS

ABSTRACT. The aim of this paper is to analyse the relevance of cyber-physical systems (CPS) in different manufacturing contexts and to study whether CPS could provide companies with competitive advantage by carrying out a better scheduling task. This paper is developed under the umbrella of contingency theory which states that certain technologies and practices are not universally applicable or relevant in every context; thus, only certain companies will benefit from using particular technologies or practices. The conclusion of this paper, developed through deductive reasoning and supported by preliminary simulation experiments and statistical tests, is that factories with an uncertain and demanding market environment as well as a complex production process could benefit the most from implementing a CPS at shop-floor level since a cyber-physical shop-floor will provide all the capabilities needed to carry out the complex scheduling task associated with this type of context. On the other hand, an increase

in scheduling performance due to a CPS implementation in factories with simple production flows and stable demand could not be substantial enough to overcome the high cost of installing a fully operational CPS. © 2019 Elsevier B.V.

Romero-Silva, R. & Hernández-López, G. (2019). Shop-floor scheduling as a competitive advantage: A study on the relevance of cyber-physical systems in different manufacturing contexts. *International Journal of Production Economics*, 224. doi: 10.1016/j.ijpe.2019.107555. Article.

Rodrigo Romero Silva

SNI Nivel I

Margarita Hurtado Hernández

SNI Nivel I

STUDYING THE EFFECTS OF THE SKEWNESS OF INTER-ARRIVAL AND SERVICE TIMES ON THE PROBABILITY DISTRIBUTION OF WAITING TIMES

ABSTRACT. Previous studies have shown that the mean queue length of a GI/G/1 system is significantly influenced by the skewness of inter-arrival times, but not by the skewness of service times. These results are limited because all the distributions considered in previous studies were positively skewed. To address this limitation, this paper investigates the effects of the skewness of inter-arrival and service times on the probability distribution of waiting times, when a negatively skewed distribution is used to model inter-arrival and service times. Subsequent to a series of experiments on a GI/G/1 queue using discrete-event simulation, results have shown that the lowest mean waiting time and the lowest variance of waiting times can be attained with a combination of positive inter-arrival skewness and negative service skewness. Results also show an interesting effect of the skewness of service times in the probability of no-delay in environments with a higher utilization factor. © 2020 Brazilian Operations Research Society.

Romero-Silva, R., Shaaban, S., Marsillac, E., & Hurtado-Hernández, M. (2020). Studying the effects of the skewness of inter-arrival and service times on the probability distribution of waiting times. *Pesquisa Operacional*, 40(2020), 1-29. doi: 10.1590/0101-7438.2020.040.00223190. Article.

Luis Alberto Rosa Sierra

SNI Nivel II

DESIGN EDUCATION A STRATEGY TO CHANGE THE PERCEPTIONS OF STUDENTS CASE STUDY OF CIUDAD JUÁREZ

ABSTRACT. Effective design can be use as a tool for reduction of crime. This suggests that graphic design interventions that seek to change perceptions could have the potential to reduce violent crime. The inquiry expects the students to work with real problems, obtaining reasons and enriching their ideas to face their social role and responsibility as professional citizens. The objective of this research is to measure the change with respect to the attitudes and discover about effective design in contemporary society. © The Editor(s) (if applicable) and The Author(s), under exclusive license to Springer Nature Switzerland AG 2020.

Rogel, E. & Rossa-Sierra, A. (2020). Design education a strategy to change the perceptions of students case study of Ciudad Juárez. In Rebelo, F. & Soares, M. (eds.), *Advances in Ergonomics in Design. AHFE 2020. Advances in Intelligent Systems and Computing*, vol 1203 (pp. 263-268). Cham, Switzerland: Springer. doi: 10.1007/978-3-030-51038-1_37. Book Chapter.

Luis Alberto Rosa Sierra

SNI Nivel II

DESIGN OF A MOBILE SUPPORT APPLICATION FOR TEENAGERS SUFFERING FROM DEPRESSION IN ZAPOPAN, MÉXICO

ABSTRACT. Suicide is the second cause of death in the world in people aged 15 to 29 years. Depression is a psychological disorder that affects more than 300 million people worldwide. This disorder is caused by different factors, whether biological, psychosocial, personality, or genetic. It is characterized by having a low state of mind, loss of interest, feelings of guilt, restlessness, sleep disturbances, decreased appetite, accompanied by feelings of sadness, which physically and mentally affects the way of feeling and thinking, arriving in extreme cases to cases of suicides or attempts of him. Nowadays, there are several types of depression, such as major depression, dysthymia, adaptive disorder, depressive episode, recurrent depressive disorder, bipolar depression, psychotic depression, atypical depression, seasonal affective disorder, each one has its own characteristics, as well as symptomatology. © The Editor(s) (if applicable) and The Author(s), under exclusive license to Springer Nature Switzerland AG 2020.

González-Cabrera, N. P., Aragón-Gómez, A. V., Durán-Aguilar, G., & Rossa-Sierra, A. (2020). Design of a mobile support application for teenagers suffering from depression in Zapopan, México. In Rebelo, F. & Soares, M. (eds.), *Advances in Ergonomics in Design. AHFE 2020. Advances in Intelligent Systems and Computing*, vol 1203. (pp. 301-306). Cham, Switzerland: Springer. doi: 10.1007/978-3-030-51038-1_42. Book Chapter.

Enrique Rosales Ruíz

Profesor investigador

FRONT2BACK: SINGLE VIEW 3D SHAPE RECONSTRUCTION VIA FRONT TO BACK PREDICTION

ABSTRACT. Reconstruction of a 3D shape from a single 2D image is a classical computer vision problem, whose difficulty stems from the inherent ambiguity of recovering occluded or only partially observed surfaces. Recent methods address this challenge through the use of largely unstructured neural networks that effectively distill conditional mapping and priors over 3D shape. In this work, we induce structure and geometric constraints by leveraging three core observations: (1) the surface of most everyday objects is often almost entirely exposed from pairs of typical opposite views; (2) everyday objects often exhibit global reflective symmetries which can be accurately predicted from single views; (3) opposite orthographic views of a 3D shape share consistent silhouettes. Following these observations, we first predict orthographic 2.5D visible surface maps (depth, normal and silhouette) from perspective 2D images, and detect global reflective symmetries in this data; second, we predict the back facing depth and normal maps using as input the front maps and, when available, the symmetric reflections of these maps; and finally, we reconstruct a 3D mesh from the union of these maps using a surface reconstruction method best suited for this data. Our experiments demonstrate that our framework outperforms state-of-the art approaches for 3D shape reconstructions from 2D and 2.5D data in terms of input fidelity and details preservation. Specifically, we achieve 12% better performance on average in ShapeNet benchmark dataset, and up to 19% for certain classes of objects (e.g., chairs and vessels). © 2020 IEEE.

Yao, Y., Schertler N., Rosales, E., Rhodin, H., Sigal, L., & Sheffer A. (2020). Front2Back: Single View 3D Shape Reconstruction via Front to Back Prediction. 2020 IEEE. 2020 IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR) (United States), Online (pp. 528-537). doi: 10.1109/CVPR42600.2020.00061. Conference Paper.

Julio César Rosas Caro

SNI Nivel I

Antonio Valderrábano González

SNI Nivel I

A DOUBLE DUAL BOOST CONVERTER WITH SWITCHING RIPPLE CANCELLATION FOR PEMFC SYSTEMS

ABSTRACT. This paper presents a current-based control for a proton-exchange membrane fuel cell using the so-called double dual boost topology. In particular, we introduce a discrete time controller that, in coordination with a particular selection of inductors and capacitors, minimizes the switching ripple at the input port (current ripple) and the output port (voltage ripple) of the double dual boost converter. This converter has a particular characteristic, in contrast to the classical interleaved boost topology, in the double dual boost, the phases of the converter can have different duty ratios. The freedom to choose the duty ration for each phase can be used to select the operative point in which the input current is equal to zero. However, if individual controllers are used for each branch of the converter, the equilibrium after a transient can differ from the minimum ripple operation point; the proposed scheme regulates the output voltage and, at the same time, ensures the equilibrium remains in the minimum ripple operation in steady state. In this way, the converter can mitigate the harmonic distortion on the current extracted from the proton-exchange membrane fuel cell, which is beneficial to improve the efficiency and lifetime of the cell, and on the output voltage delivered to an output direct current bus. The results of the experiment are presented to validate the principles of the proposed system. © 2020 by the authors. Licensee MDPI, Basel, Switzerland.

Villarreal-Hernández, C. A., Loranca-Coutiño, J., Mayo-Maldonado, J. C., Valdez-Resendiz, J. E., García-Vite, P. M., Valderrábano-González, A., & Rosas-Caro, J. C. (2020). A double dual boost converter with switching ripple cancellation for pemfc systems. *Electronics (Switzerland)*, 9(10), 1-17. doi: 10.3390/electronics9101592. Article.

Julio César Rosas Caro

SNI Nivel I

Leonardo Jesús Valdivia Parga

SNI Nivel C

A NOVEL BOOST CONVERTER TOPOLOGY WITH NON-PULSATING INPUT AND OUTPUT CURRENT

ABSTRACT. This paper proposes a new fourth-order dc-dc boost converter, developed as an improved version of the traditional Zeta converter, the main

advantages of the proposed quasi-zeta converter are: (i) it can be constructed with a commercial half-bridge transistors package, in contrast with the traditional Zeta converter in which the diode and transistor are not connected to the same node, this characteristic makes easier constructing a high power converter with the proposed configuration, (iii) inductors drain a current smaller than the input current, which reduces the size of inductors, finally, (iii) both input and output current are non-pulsating, which reduces the possibility of having EMI problems. Converter design expressions are formulated with a time-domain analysis. The large signal non-linear model is provided along with a linear small-signal approximation. A comparative evaluation shows the proposed converter requires 55% to the energy stored in inductors to comply with a required input current ripple in comparison with the super-boost converter. Experimental results are provided to verify the principle of the proposed converter. © 2020 IEEE.

Garza-Arias, E., Rosas-Caro, J. C., Valdez-Reséndiz, J. E., Mayo-Maldonado, J. C., Escobar-Valderrama, G., Loranca-Coutino, J., Villarreal-Hernández, C., & Valdivia, L. J. (2020). A Novel Boost Converter Topology with Non-Pulsating Input and Output Current. *2020 IEEE. 2020 IEEE Energy Conversion Congress and Exposition (United States)*, Detroit (pp. 4816-4821). doi: 10.1109/ECCE44975.2020.9235403. Conference Paper.

Julio César Rosas Caro

SNI Nivel I

AN EVOLUTIONARY ALGORITHM-BASED PWM STRATEGY FOR A HYBRID POWER CONVERTER

ABSTRACT. In the past years, the interest in direct current to direct current converters has increased because of their application in renewable energy systems. Consequently, the research community is working on improving its efficiency in providing the required voltage to electronic devices with the lowest input current ripple. Recently, a hybrid converter which combines the boost and the Cuk converter in an interleaved manner has been introduced. The converter has the advantage of providing a relatively low input current ripple by a former strategy. However, it has been proposed to operate with dependent duty cycles, limiting its capacity to further decrease the input current ripple. Independent duty cycles can significantly reduce the input current ripple if the same voltage gain is achieved by an appropriate duty cycle combination. Nevertheless, finding the optimal duty cycle combination is not an easy task. Therefore, this article proposes a new pulse-width-modulation strategy for the hybrid interleaved boost-Cuk converter. The strategy includes the development of a novel mathematical model to describe the relationship

between independent duty cycles and the input current ripple. The model is introduced to minimize the input current ripple by finding the optimal duty cycle combination using the differential evolution algorithm. It is shown that the proposed method further reduces the input current ripple for an operating range. Compared to the former strategy, the proposed method provides a more balanced power-sharing among converters.

Rodríguez, A., Alejo-Reyes, A., Cuevas, E., Beltrán-Carbajal, F., & Rosas-Caro, J. C. (2020). An evolutionary algorithm-based PWM strategy for a hybrid power converter. *Mathematics*, 8(8). doi: 10.3390/MATH8081247. Article.

Julio César Rosas Caro

SNI Nivel I

Omar Fernando Ruíz Martínez

SNI Nivel C

DATA-DRIVEN BASED CONTROL APPLIED TO DC NETWORK CONVERTERS FOR VOLTAGE BUS STABILIZATION

ABSTRACT. This paper focuses on the control design of DC-DC converters delivering power into energy distribution networks. The scenario where the destabilizers of the system called constant power loads (CPLs) are presented. The idea of the proposed scheme is to take advantage of the so-called persistency of excitation conditions, which is used to elaborate a controller without the need for large mathematical models. The proposed data-driven approach can guarantee stability by solving a set of Lyapunov Linear Matrix Inequalities (LMIs). The stabilizing control scheme was designed using the linear difference systems and quadratic difference forms (QdF) concepts of behavioral system theory. Besides, a comparison between simulation and experimental results are presented to validate the theoretical design and illustrate the benefits of this scheme. © 2020 IEEE.

Loranca-Coutino, J., Villarreal-Hernández, C. V., Ruiz-Martínez, O. F., Mayo-Maldonado, J. C., Valdez-Reséndiz, J. E., Escobar, G., Rosas-Caro, J. C., & Guillen, D. (2020). Data-Driven Based Control Applied to DC Network Converters for Voltage Bus Stabilization. *ECCE 2020*. 2020 IEEE Energy Conversion Congress and Exposition (ECCE) (United States), Detroit (pp. 6185-6191). doi: 10.1109/ECCE44975.2020.9236030. Conference Paper.

Julio César Rosas Caro

SNI Nivel I

DATA-DRIVEN CONTROL OF LVDC NETWORK CONVERTERS: ACTIVE LOAD STABILIZATION

ABSTRACT. This paper addresses the (model-free) data-driven control of power converters, acting as distributed generators, in low voltage direct current (LVDC) networks (e.g., DC microgrids, DC distributed power systems, DC buses with multiple sources and loads, etc.). Since traditional stand-alone control design, cannot guarantee stability when converters are connected to a network, it is proposed a deterministic solution that does not require the network model-an approach purely based on measurement data. This is a suitable way to overcome common issues when using a model-based approach, e.g., the use of an excessive number of variables and equations, the presence of un-modeled dynamics, unknown parameters and/or the lack of first principle model equations. To corroborate the advantages of the proposed approach, the present work addresses an extreme but also realistic scenario: weak networks with active loads, such as constant power loads (CPLs). It is also shown that the proposed scheme guarantees stability in a rigorous deterministic way-using a Lyapunov approach based on coefficient matrices directly constructed from data. Simulation results using a multi-bus LVDC distribution network, based on PSCAD/EMTDC, are provided as proof of concept. © 2010-2012 IEEE.

Ruiz-Martínez, O. F., Mayo-Maldonado, J. C., Escobar, G., Frías-Araya, B. A., Valdez-Reséndiz, J. E., Rosas-Caro, J. C., & Rapisarda, P. (2020). Data-Driven Control of LVDC Network Converters: Active Load Stabilization. *IEEE Transactions on Smart Grid*, 11(3), 2182-2194. doi: 10.1109/TSG.2019.2949259. Article.

Julio César Rosas Caro

SNI Nivel I

Omar Fernando Ruíz Martínez

SNI Nivel C

ENERGY-BASED STABILIZING CONTROLLERS FOR DC-DC CONVERTERS FEEDING CONSTANT POWER LOADS

ABSTRACT. In this paper is studied and presented the solution for the instability problem caused by the interconnection of DC converters with constant power loads (CPLs). A linear and a nonlinear energy-based approaches are proposed. Without the presence of CPLs, the stability of the DC-DC power converter is intrinsic, while with CPLs the stability must be induced, a task that is not easy with traditional control approaches. This paper shows that the stabilization of the power converter can be achieved

in pure physical terms, using power and energy as the primary objectives, which can be done in a linear and a nonlinear approach. Also, considering the energy as the perspective for the problem provides a physical explanation to the stability issues, furthermore, it provides a clear practical solution, because now it is possible to link the parameters of the controller to nominal specifications that are used for power converter design. In this way, the strategies based on the power and energy are now based on known approaches, which is a difference to known approaches, whose stability are based on frequency domain, eigenvalue and immittance criteria. Experimental results are presented to corroborate the theoretical analysis. © 2020 IEEE.

Villarreal-Hernández, C. A., Loranca-Coutino, J., Ruiz-Martínez, O. F., Mayo-Maldonado, J. C., Valdez-Reséndiz, J. E., Rosas-Caro, J. C., & Escobar, G.; Guillen, D. (2020). Energy-based Stabilizing Controllers for DC-DC Converters Feeding Constant Power Loads. 2020 IEEE. 2020 IEEE Energy Conversion Congress and Exposition (ECCE) (United States), Detroit (pp. 2548-2554). doi: 10.1109/ECCE44975.2020.9235848. Conference Paper.

Julio César Rosas Caro

SNI Nivel I

Omar Fernando Ruíz Martínez

SNI Nivel C

HIGH GAIN BOOST CONVERTER WITH REDUCED VOLTAGE IN CAPACITORS FOR FUEL-CELLS ENERGY GENERATION SYSTEMS

ABSTRACT. This work presents a power-electronics based system for renewable energy applications, the system is driven with an only one switch quadratic type boost converter, the discussed converter is based on a stack of switching stages which provide a large voltage gain, a desirable feature for fuel cell generation systems, the converters gain function is the quadratic boost-type converters; furthermore, the topology can be extended. The major benefit of the topology is that there is not a capacitor that sustains the entire output voltage, in contrast to other similar topologies in which there is a capacitor rated to the output port voltage, there is no high voltage capacitor in this system. Experimental verification is presented to confirm the system principles; experiments included a fuel cell emulator that was built and used for the experiments. © 2020 by the authors. Licensee MDPI, Basel, Switzerland.

Loranca-Coutiño, J., Villarreal-Hernández, C. A., Mayo-Maldonado, J. C., Valdez-Reséndiz, J. E., López-Núñez, A. R., Ruiz-Martínez, O. F., & Rosas-Caro, J. C. (2020). High gain boost converter with reduced voltage in capacitors for fuel-cells energy generation systems. *Electronics (Switzerland)*, 9(9), 1-20. doi: 10.3390/electronics9091480. Article.

Julio César Rosas Caro

SNI Nivel I

IMPROVEMENT OF ULTRACAPACITORS-ENERGY USAGE IN FUEL CELL BASED HYBRID ELECTRIC VEHICLE

ABSTRACT. Hybrid electric power systems based on fuel cell stack and energy storage sources like batteries and ultracapacitors are a plausible solution to vehicle electrification due to their balance between acceleration performance and range. Having a high degree of hybridization can be advantageous, considering the different characteristics of the power sources. Some parameters to be considered are: specific power and energy, energy and power density, lifetime, cost among others. Ultracapacitors (UC) are of particular interest in electric vehicle applications due to its high-power capability, which is commonly required during acceleration. UCs are commonly used without a power electronics interface due to the high-power processing requirement. Although connecting UCs directly to the DC bus, without using a power converter, presents considerable advantages, the main disadvantage is related to the UC energy-usage capability, which is limited by constant DC bus control. This paper proposes a novel energy-management strategy based on a fuzzy inference system, for fuel-cell/battery/ultracapacitor hybrid electric vehicles. The proposed strategy is able to control the charge and discharge of the UC bank in order to take advantage of its energy storage capability. Experimental results show that the proposed strategy reduces the waste of energy due to dynamic brake in 14%. This represents a reduction in energy consumption from 218 Wh/km to 192 Wh/km for the same driving conditions. By using the proposed energy management strategy, the estimated fuel efficiency in miles per gallon equivalent was also increase from 96 mpgge to 109 mpgge. 2020 Hydrogen Energy Publications LLC

Valdez-Reséndiz, J. E., Rosas-Caro, J. C., Mayo-Maldonado, J. C., Claudio-Sánchez, A., Ruiz-Martínez, O., & Sánchez, V. M. (2020). Improvement of ultracapacitors-energy usage in fuel cell based hybrid electric vehicle. *International Journal of Hydrogen Energy*, 45(26), 13746-13756. doi: 10.1016/j.ijhydene.2019.12.201. Article.

Julio César Rosas Caro

SNI Nivel I

MINIMUM CURRENT RIPPLE POINT TRACKING CONTROL FOR INTERLEAVED DUAL SWITCHED-INDUCTOR DC-DC CONVERTERS

ABSTRACT. This article presents a novel output current/voltage control for interleaved dc-dc converters with dual switched input inductors, i.e., interleaved

input inductors controlled by independent switches. The proposed approach is able to guarantee a minimum input current ripple point tracking despite of variations on the operating point. The controller encompasses three control stages: current stabilization, output-voltage regulation, and minimum input current ripple control. In contrast with the two first loops, the latter is a novel stage introduced in this article to allow operation with minimum input current ripple in the whole operating region. That is, even though the converter has been designed for operation with minimum ripple in a given operating point, the scheme is able to dynamically deviate from this point to a new one where the ripple is minimized and the output voltage remains constant. The proposed scheme is experimentally validated using a laboratory prototype of a high-gain interleaved multilevel boost converter. © 1982-2012 IEEE.

Villarreal-Hernández C. A., Ruiz-Martínez O. F., Mayo-Maldonado J. C., Escobar G., Valdez-Reséndiz J. E., & Rosas-Caro J. C. (2021). Minimum Current Ripple Point Tracking Control for Interleaved Dual Switched-Inductor DC-DC Converters. *IEEE Transactions on Industrial Electronics*, 68(1), 175-185. doi: 10.1109/TIE.2019.2962458. Article.

Julio César Rosas Caro

SNI Nivel I

Omar Fernando Ruíz Martínez

SNI Nivel C

MINIMUM CURRENT-RIPPLE POINT TRACKING FOR RENEWABLE ENERGY APPLICATIONS

ABSTRACT. This paper presents a novel output voltage control of a high-gain interleaved DC-DC converter that is able to track a minimum input-current ripple. The controller encompasses three stages: a current stabilization loop, an output-voltage controller and a minimum ripple point tracking control law. The latter is a novel stage that enables a full operating region for which the input-current ripple is minimized. The proposed scheme was validated by implementing experiments in closed-loop operation. In this way, the DDBC is able to both mitigate the harmonic distortion on the current extracted from the PEMFC, which is beneficial to improve the efficiency and life-time of the cell; and on the output-voltage delivered to an output DC bus. © 2020 IEEE.

Villarreal-Hernández, C. A., Loranca-Coutino, J., Ruiz-Martínez, O. F., Mayo-Maldonado, J. C., Valdez-Reséndiz, J. E., Rosas-Carot, J. C., & Guillen, D. (2020). Minimum Current-Ripple Point Tracking for Renewable Energy Applications. 2020 IEEE. 2020 IEEE Energy Conversion Congress and Exposition (ECCE) (United States), Detroit (pp. 4808-4815). doi: 10.1109/ECCE44975.2020.9235821. Conference Paper.

Julio César Rosas Caro

SNI Nivel I

QUADRATIC BOOST CONVERTER WITH LOW-OUTPUT-VOLTAGE RIPPLE

ABSTRACT. This study proposes a non-isolated quadratic boost converter (QBC) that features a low-output-voltage ripple with respect to traditional QBCs. This advantage is in contrast with other topologies that require a higher amount of stored energy by capacitors to achieve the same output-voltage ripple specification. This benefit permits to design a compact converter, since the size of capacitors is proportional to their energy storage rating. Moreover, the proposed transformerless topology is suitable for applications that require high-voltage gains as in the case of renewable energy applications. The main properties of the converter are corroborated as well as its advantages by providing mathematical models, analytical waveforms and experiments. © The Institution of Engineering and Technology 2020.

López-Santos, O., Mayo-Maldonado, J. C., Rosas-Caro, J. C., Valdez-Reséndiz, J. E., Zambrano-Prada, D. A., & Ruiz-Martínez, O. F. (2020). Quadratic boost converter with low-output-voltage ripple. *IET Power Electronics*, 13(8), 1605-1612. doi: 10.1049/iet-pel.2019.0472. Article.

Omar Fernando Ruíz Martínez

SNI Nivel C

A CURRENT-MODE CONTROLLER FOR AN HB-NPC INVERTER USING THE VIRTUAL-GROUND TRAJECTORY FOR POWER INJECTION IN PV SYSTEMS

ABSTRACT. This paper presents the analysis and control design for an HB-NPC power converter which is used in a transformerless photovoltaic systems, and is aimed to guarantee active power injection to the grid. The system includes a Virtual-Ground connection to mitigate the leakage-ground currents, which are produced by the effect of common-mode voltage variations across the stray capacitances. The latter arise between the photovoltaic cells and their grounded frame. The system considers an LCL output filter with split capacitors to allow the virtual ground connection. Moreover, the proposed controller provides active damping of the typical third-order response presented by LCL filters. The proposed control scheme consists on a proportional-plus-resonant controller acting on the inverter-side current error. Finally, experimental results are provided to demonstrate the benefits of the proposed solution in the leakage-ground current mitigation as well as in the active power injection to the grid. © 2020 IEEE.

Iturriaga-Medina, S., Martínez-Rodríguez, P. R., Escobar, G., Mayo-Maldonado, J. C., Valdez-Reséndiz, J. E., Guillen-Aparicio, D., & Ruiz-Martínez, O. F. (2020). A Current-Mode Controller for an HB-NPC Inverter Using the Virtual-Ground Trajectory for Power Injection in PV Systems. 2020 IEEE. 2020 IEEE Energy Conversion Congress and Exposition (United States), Detroit (pp. 356-361). doi: 10.1109/ECCE44975.2020.9236152. Conference Paper.

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Investigador Titular A, SNI Nivel I

ANALYSIS OF MEAT COLOR CHANGE USING COMPUTER VISION

ABSTRACT. Sensory parameters are crucial for making a purchase decision in meat products. Thus, consumers will guide their choice based on their color. They will seek cherry red meat; when the meat turns brown due to the myoglobin's oxidation, the product is no longer desired. Therefore, the food industry must have a system that could be effective and give just-in-Time information regarding changes in color to maintain the quality during the shelf life that consumers expect. This research aims to present a methodology based on computer vision to analyze the change of color in meat. We used images taken of different beef cuts and tested on different days. The Euclidean distance on the average of colors could be used. However, the method proposed in this study is the use of Kullback Leibler divergence, which takes the meat not only at one color point but as a cloud of points. The results were obtained with the Kullback Leibler divergence demonstrated that it is possible to calculate differences in meat images when passing the days. The practical application for this type of analysis would be in the retail industry in order to give just in time information about the quality of meat. © 2020 IEEE.

Meza, G., Sánchez, C. N., Orvañanos-Guerrero, M. T., & Domínguez-Soberanes, J. (2020). Analysis of Meat Color Change using Computer Vision. 2020 IEEE. 2020 IEEE International Autumn Meeting on Power, Electronics and Computing (ROPEC) (Mexico), Ixtapa. doi: 10.1109/ROPEC50909.2020.9258756. Conference Paper.

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Josué Ortiz Medina

SNI Nivel I

MODELING OF AMORPHOUS-CARBON CELLS FOR MOLECULAR DYNAMICS SIMULATIONS

ABSTRACT. The modeling of starting molecular structures before their analysis through computational methods is usually a critical step for their properties determination. In the case of amorphous carbon (a-C) simulations, including molecular dynamics (MD) or first principles (ab-initio) routines, the proportion between sp, sp² and sp³ carbon hybridization are fundamental parameters, with direct implications on the electronic and structural properties of the materials under analysis. In this paper, a method for controlling the fraction of sp²-hybridized carbon within a-C structures is proposed, by means of an algorithm that generates a-C cells appropriate as starting structures for most of the MD and ab-initio simulation packages. © 2019 IEEE.

Sánchez, C. N., Domínguez-Soberanes, J., & Ortiz-Medina, J. (2019). Modeling of Amorphous-Carbon Cells for Molecular Dynamics Simulations. 2019 IEEE. 39th Central America and Panama Convention (CONCAPAN XXX-IX) (Guatemala), Guatemala City. doi: 10.1109/CONCAPANXXXIX47272.2019.8977068. Conference Paper.

Fidencio Tapia Rodríguez

SNI Nivel C

DESIGN OF AN AERONAUTIC PITOT PROBE WITH A REDUNDANT HEATING SYSTEM INCORPORATING PHASE CHANGE MATERIALS

ABSTRACT. The aim of this work is the design of a pitot probe (PP) prototype in order to retard the cool down of the tip, in case of a heating element failure. The viability of operation in flight conditions is evaluated. The design consists of a redundant heating system incorporating phase change materials (PCM). Combining experimental observations of ice formation with the implementation of the conjugate heat transfer (CHT) model, with the addition of the heat release due to the phase change of the PCM, the numerical evaluation is developed. The modeling assumptions and numerical implementation of the phase change process are presented. Then, the selection an appropriate PCM is based on the low flammability and volume dilation and the quantitative effects of the material properties on the heat transfer. A commercial PCM solution based on salt

hydrates was chosen as the most adequate for the design. The parametric design of the prototype, based on the design of experiment method and fractional factorial testing, is established. A multiple linear regression model was obtained in order to maximize the cooling retardation. The numerical simulations demonstrate that the prototype PP tip temperature remains 194 s longer above 0 °C than that of the conventional model analyzed. © 2020 Elsevier Ltd.

Jäckel, R., Tapia, F., Gutiérrez-Urueta, G., & Monreal Jiménez, C. (2020). Design of an aeronautic pitot probe with a redundant heating system incorporating phase change materials. *Flow Measurement and Instrumentation*, 76. doi: 10.1016/j.flowmeasinst.2020.101817. Article.

Fidencio Tapia Rodríguez

SNI Nivel C

EXPERIMENTAL STUDY OF ICE FORMATION ON AN AERONAUTICAL PITOT PROBE

ABSTRACT. In this work, the cool-down and ice accumulation on an aeronautic Pitot probe (PP) in case of a heating element failure was studied experimentally in a climatic wind tunnel (CWT). Through injector nozzles located in front of the test section, atomized water was introduced into the tunnel in order to simulate the presence of humidity found in different cloud types. Using high-resolution cameras, the subsequent ice accumulation along the PP was recorded. The experiment runs were taken out under three different conditions, controlling the air temperature, flow velocity and liquid water content (LWC) in the test section. The flow conditions in the CWT have dynamic similarity with those encountered at cruise speeds of common single-engined propeller aircraft. Analyzing the indicated pressure measured through the PP's pressure ports, it was possible to correlate the (cone-shaped) ice accumulation on the stagnation pressure port to the measurement error for one test condition. For the other two test conditions, it was observed that the ice cone's lateral section grew so fast, that it did not allow the blockage of the stagnation port, keeping it in contact with the atmosphere and thus performing correctly. © 2018 Begell House Inc. All rights reserved.

Jäckel, R., Urueta, G. L. G., Rodríguez, F. T., Loureiro, J. B. R., & Jiménez, C. M. (2018). Experimental study of ice formation on an aeronautical Pitot probe. *TFESC 2018. 3rd Thermal and Fluid Engineering Summer Conference (TFEC)* (United States), Fort Lauderdale (pp. 61-66). doi: 10.1615/TFESC2018.asp.024485. Conference Paper.

Fidencio Tapia Rodríguez

SNI Nivel C

SYNERGISTIC EFFECTS OF RUBBER-TIRE-POWDER AND FLUOROGYPSUM IN CEMENT-BASED COMPOSITE

ABSTRACT. Currently, the use of waste materials in Portland cement mixtures and the reduction of the use of clinker is important due to environmental issues. One of the waste materials of importance for the scientific community is end-of-life tires, because there are millions of tires in landfills; however, there are other materials in similar circumstances such as fluorogypsum. In this study, the effect of incorporating two waste materials (rubber-tire-powder and fluorogypsum) was studied in a Portland cement mixture diluted with CaCO₃. The remnant of H₂SO₄ contained on the surface of fluorogypsum is an option to chemically treat the surface of the tire particles and improve their interaction with the cement matrix. The characterization of the chemically treated material, the hydration evolution and the physico-mechanical properties were evaluated. In the hydration process, it was observed that a low fluorogypsum content slightly accelerated the cement reactions, while the rubber-tire-powder inhibited them. Regarding the cement-rubber mixture, the cement-rubber-fluorogypsum mixture had a recovery of 28.3 % in the compressive strength and 36.0 % in the modulus of elasticity. The results of this research show that using the two waste materials simultaneously is advantageous because it improves the properties of the cement-tire and avoids the use of other surface treatments. This makes it possible to obtain a more ecological and relatively cheaper cementitious material than with the application of other surface treatments on the rubber-tire particles.

Rodríguez, R. S. L., Domínguez, O., Díaz, A. J. H., García, C., Tapia, F. (2021). Synergistic effects of rubber-tire-powder and fluorogypsum in cement-based composite. *Case Studies in Construction Materials*, 14. doi: 10.1016/j.cscm.2020.e00471. Article.

Antonio Valderrábano González

SNI Nivel I

ADAPTIVE CONTROL OF 3-DOF DELTA PARALLEL ROBOT

ABSTRACT. In this paper an adaptive neural network controller is used to solve the problem of tracking trajectories of a delta parallel robot (DPR) with three degrees of freedom. This controller used an adaptive artificial B-Spline neural network (BSNN) for online training. The BSNN improves the performance of DPR on a closed loop and update the parameters of control scheme online. This algorithm sets the control signal without using a detailed mathe-

mathematical model nor exact values of the parameters of the DPR. The proposed adaptive controller was compared with a traditional control based a PD +G controller. Analytical and numerical results prove the robust and efficient performance of the adaptive neural network controller. © 2019 IEEE.

Aguilar-Mejía, O., Escorcía-Hernández, J. M., Tapia-Olvera, R., Minor-Popocatl, H., Valderrábano-González, A. (2019). Adaptive Control of 3-DOF Delta Parallel Robot. 2019 IEEE. 2019 IEEE International Autumn Meeting on Power, Electronics and Computing (ROPEC) (Mexico), Ixtapa. doi: 10.1109/ROPEC48299.2019.9057075. Conference Paper.

Leonardo Jesús Valdivia Parga

SNI Nivel C

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SNI Nivel I

AN ENERGY MODEL USING SLEEPING ALGORITHMS FOR WIRELESS SENSOR NETWORKS UNDER PROACTIVE AND REACTIVE PROTOCOLS: A PERFORMANCE EVALUATION

ABSTRACT. The continuous evolution of the Internet of Things (IoT) makes it possible to connect everyday objects to networks in order to monitor physical and environmental conditions, which is made possible due to wireless sensor networks (WSN) that enable the transfer of data. However, it has also brought about many challenges that need to be addressed, such as excess energy consumption. Accordingly, this paper presents and analyzes wireless network energy models using five different communication protocols: Ad Hoc On-Demand Distance Vector (AODV), Multi-Parent Hierarchical (MPH), Dynamic Source Routing (DSR), Low Energy Adaptive Clustering Hierarchy (LEACH) and Zigbee Tree Routing (ZTR). First, a series of metrics are defined to establish a comparison and determine which protocol exhibits the best energy consumption performance. Then, simulations are performed and the results are compared with real scenarios. The energy analysis is conducted with three proposed sleeping algorithms: Modified Sleeping Crown (MSC), Timer Sleeping Algorithm (TSA), and Local Energy Information (LEI). Thereafter, the proposed algorithms are compared by virtue of two widely used wireless technologies, namely Zigbee and WiFi. Indeed, the results suggest that Zigbee has a better energy performance than WiFi, but less redundancy in the topology links, and this study favors the analysis with the simulation of protocols with different nature. The tested scenario is implemented into a university campus to show a real network running. © 2020 by the authors.

Del-Valle-Soto, C., Velázquez, R., Valdivia, L. J., Giannoccaro, N. I., & Visconti, P. (2020). An energy model using sleeping algorithms for wireless sensor networks under proactive and reactive protocols: A performance evaluation. *Energies*, 13(11). doi: 10.3390/en13113024. Article.

Leonardo Jesús Valdivia Parga

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SNI Nivel I

PERFORMANCE EVALUATION OF ACTIVE AND PASSIVE HAPTIC FEEDBACK IN SHAPE PERCEPTION

ABSTRACT. Haptic technology allows producing computergenerated signals that a perceiver experiences through touch. In general, haptic devices can be classified as active and passive. In this paper, we present a performance evaluation of a group of 10 voluntary subjects in a task of shape perception when both active and passive kinesthetic haptic feedback are provided. The results of a series of psychophysical experiments show that active haptics is superior for shape recognition: Active haptics enhances the perception of surfaces while passive haptics conveys the sensation of being guided along pathways. In addition, the guidance nature of passive haptics makes the pathway direction easy to recognize. This last observation can be effectively exploited in more challenging tasks such as navigation/mobility assistance. © 2019 IEEE.

Velazquez, R., Pissaloux, E., Del-Valle-Soto, C., Arai, M., Valdivia, L. J., Del Puerto-Flores, J. A., & Gutierrez, C. A. (2019). Performance Evaluation of Active and Passive Haptic Feedback in Shape Perception. 2019 IEEE. 39th Central America and Panama Convention (CONCAPAN XXXIX) (Guatemala), Guatemala City. doi: 10.1109/CONCAPANXXXIX47272.2019.8977077. Conference Paper.

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CRYPTOCURRENCIES: A FUTURISTIC PERSPECTIVE OR A TECHNOLOGICAL STRATEGY

ABSTRACT. Currently, there are several cryptocurrencies based on blockchain technology and a debate whether these kinds of assets are really a currency or if they are only an instrument for speculation is prevalent. Cryptocurrencies are technologies that allow sending value from person to person, without intermediaries. A cryptocurrency is digital money, which uses a type of encryption to protect transactions in a public and decentralized manner. This work argues that cryptocurrencies have intrinsic value and that their price is not only determined by supply and demand. It is concluded that this kind of digital asset contains some value drivers beyond the profitability that is generated through speculation. Some of the elements of value are cost of production associated with intellectual capacity, baggage of knowledge, time and resources invested in the creation process. Those resources can be found in electricity and sophisticated computer equipment, codes generating smaller units of measure, networks without physical barriers, artificial intelligence and human enhancement, and varied payment methods. © 2021, The Editor(s) (if applicable) and The Author(s), under exclusive license to Springer Nature Switzerland AG.

Del-Valle-Soto, C., & Rossa-Sierra, A. (2021). Cryptocurrencies: A Futuristic Perspective or a Technological Strategy. In Ahram, T. (ed.), *Advances in Artificial Intelligence, Software and Systems Engineering*. AHFE 2020. *Advances in Intelligent Systems and Computing*, vol 1213 (pp. 504-509). Cham, Switzerland: Springer. doi: 10.1007/978-3-030-51328-3_69. Conference Paper.

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DEVELOPMENT OF SENSORS-BASED AGRI-FOOD TRACEABILITY SYSTEM REMOTELY MANAGED BY A SOFTWARE PLATFORM FOR OPTIMIZED FARM MANAGEMENT

ABSTRACT. The huge spreading of Internet of things (IoT)-oriented modern technologies is revolutionizing all fields of human activities, leading several benefits and allowing to strongly optimize classic productive processes. The agriculture field is also

affected by these technological advances, resulting in better water and fertilizers' usage and so huge improvements of both quality and yield of the crops. In this manuscript, the development of an IoT-based smart traceability and farm management system is described, which calibrates the irrigations and fertigation operations as a function of crop typology, growth phase, soil and environment parameters and weather information; a suitable software architecture was developed to support the system decision-making process, also based on data collected on-field by a properly designed solar-powered wireless sensor network (WSN). The WSN nodes were realized by using the ESP8266 NodeMCU module exploiting its microcontroller functionalities and Wi-Fi connectivity. Thanks to a properly sized solar power supply system and an optimized scheduling scheme, a long node autonomy was guaranteed, as experimentally verified by its power consumption measures, thus reducing WSN maintenance. In addition, a literature analysis on the most used wireless technologies for agri-food products' traceability is reported, together with the design and testing of a Bluetooth low energy (BLE) low-cost sensor tag to be applied into the containers of agri-food products, just collected from the fields or already processed, to monitor the main parameters indicative of any failure or spoiling over time along the supply chain. A mobile application was developed for monitoring the tracking information and storing conditions of the agri-food products. Test results in real-operative scenarios demonstrate the proper operation of the BLE smart tag prototype and tracking system. © 2020 by the authors. Licensee MDPI, Basel, Switzerland.

Visconti, P., de Fazio, R., Velázquez, R., Del-Valle-soto, C., & Giannoccaro, N. I. (2020). Development of sensors-based agri-food traceability system remotely managed by a software platform for optimized farm management. *Sensors (Switzerland)*, 20(13), 1-43. doi: 10.3390/s20133632. Article.

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ENERGY-EFFICIENT CLUSTERING ROUTING PROTOCOL FOR WIRELESS SENSOR NETWORKS BASED ON YELLOW SADDLE GOATFISH ALGORITHM

ABSTRACT. The usage of wireless sensor devices in many applications, such as in the Internet of Things and monitoring in dangerous geographical spaces, has increased in recent years. However, sensor nodes have limited power, and battery replacement is not viable in most cases. Thus, energy savings in Wireless Sensor Networks (WSNs) is the primary

concern in the design of efficient communication protocols. Therefore, a novel energy-efficient clustering routing protocol for WSNs based on Yellow Saddle Goatfish Algorithm (YSGA) is proposed. The protocol is intended to intensify the network lifetime by reducing energy consumption. The network considers a base station and a set of cluster heads in its cluster structure. The number of cluster heads and the selection of optimal cluster heads is determined by the YSGA algorithm, while sensor nodes are assigned to its nearest cluster head. The cluster structure of the network is reconfigured by YSGA to ensure an optimal distribution of cluster heads and reduce the transmission distance. Experiments show competitive results and demonstrate that the proposed routing protocol minimizes the energy consumption, improves the lifetime, and prolongs the stability period of the network in comparison with the stated of the art clustering routing protocols. © 2020 by the authors.

Rodríguez, A., Del-Valle-Soto, C., & Velázquez, R. (2020). Energy-efficient clustering routing protocol for wireless sensor networks based on yellow saddle goatfish algorithm. *Mathematics*, 8(9). doi: 10.3390/math8091515. Article.

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SNI Nivel C

ENERGY MANAGEMENT STRATEGY FOR ULTRACAPACITORS IN HYBRID ELECTRIC VEHICLES

ABSTRACT. Electric vehicles EV are attracting attention due to their environmentally friendly operation; they market penetration may require the installation of a large number of charging stages, which is expensive and challenging from the logistic point of view. Hybrid electric vehicles HEV, may get charged from different sources which makes a flexible operation, the combination of a fuel cell, a battery, and an ultra-capacitor represents a plausible solution, ultracapacitors provide the power density required for the acceleration, and the fuel cell provides the energy density required to have a good autonomy. This manuscript proposes a fussy-logic-based energy administration strategy for an HEV feed by a set of a fuel cell, a battery, and an ultra-capacitor. The proposed strategy controls the state of charge of the ultracapacitor, considering their superior energy storage capability. Experimental results demonstrate that the proposed strategy reduces the waste of energy by 14%. This leads to energy savings, the

vehicle consumed 218 Wh per km without the proposed strategy against 192 Wh per km without it, for the same example of the driving path; the estimated fuel efficiency increased 96 to 109 miles per gallons. © 2020 IEEE.

Villarreal-Hernandez, C., Loranca-Coutino, J., Ruiz-Martinez, O. F., Mayo-Maldonado, J. C., Valdez-Resendiz, J. E., Rosas-Caro, J. C., Escobar-Valderrama, G., & Del-Valle-Soto, C. (2020). Energy Management Strategy for Ultracapacitors in Hybrid Electric Vehicles. *2020 IEEE Energy Conversion Congress and Exposition (ECCE) (United States), Detroit* (pp. 3691-3697). doi: 10.1109/ECCE44975.2020.9235684. Conference Paper.

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SNI Nivel I

WIRELESS SENSOR NETWORK ENERGY MODEL AND ITS USE IN THE OPTIMIZATION OF ROUTING PROTOCOLS

ABSTRACT. In this study, a Wireless Sensor Network (WSN) energy model is proposed by defining the energy consumption at each node. Such a model calculates the energy at each node by estimating the energy of the main functions developed at sensing and transmitting data when running the routing protocol. These functions are related to wireless communications and measured and compared to the most relevant impact on an energy standpoint and performance metrics. The energy model is validated using a Texas Instruments CC2530 system-on-chip (SoC), as a proof-of-concept. The proposed energy model is then used to calculate the energy consumption of a Multi-Parent Hierarchical (MPH) routing protocol and five widely known network sensors routing protocols: Ad-hoc On-demand Distance Vector (AODV), Dynamic Source Routing (DSR), ZigBee Tree Routing (ZTR), Low Energy Adaptive Clustering Hierarchy (LEACH), and Power Efficient Gathering in Sensor Information Systems (PEGASIS). Experimental test-bed simulations were performed on a random layout topology with two collector nodes. Each node was running under different wireless technologies: Zigbee, Bluetooth Low Energy, and LoRa with WiFi. The objective of this work is to analyze the performance of the proposed energy model in routing protocols of diverse nature: reactive, proactive, hybrid and energy-aware. Experimental results show that the MPH routing protocol consumes 16%, 13%, and 5% less energy when compared to AODV, DSR, and ZTR, respectively; and it presents only 2% and 3% of greater energy consumption with respect to the energy-aware PEGASIS and

LEACH protocols, respectively. The proposed model achieves a 97% accuracy compared to the actual performance of a network. Tests are performed to analyze the consumption of the main tasks of a node in a network. © 2020 by the authors.

Del-Valle-Soto, C., Mex-Perera, C., Nolasco-Flores, J. A., Velázquez, R., & Rossa-Sierra, A. (2020). Wireless sensor network energy model and its use in the optimization of routing protocols. *Energies*, 13(3). doi: 10.3390/en13030728. Article.

Jorge Varona Salazar

SNI Nivel I

A NOVEL ELECTROTHERMAL COMPLIANCE MICROGRIPPER

ABSTRACT. In this paper, a novel microgripper based on two perpendicular arrangements of beams and a chevron actuator is shown. In each perpendicular arrangement, the constrained displacement of the double clamped beams, joined at their endpoint, produces a buckling in each beam, which favors the displacement of each arm of the microgripper, normally open. These arrangements constitute the highly flexible structures of the microgripper. Their buckling is produced by the force applied by chevron arrow, producing a reaction force in the range of 174.44 μN in the microgripper jaws. Chevron actuator is fed by a thermal source. Temperature in microgripper tips is of 34.42°C and the operation frequency is 33.966 kHz, at maximum load thermal applied of 200°C. The mechanical, thermal and modal analyses of this integrated structure was supported by SIMSOLID™, based on Finite Element Analysis. The simulation was developed with Polysilicon as structural material. © 2019 IEEE.

Vargas-Chable, P., Ferrara-Bello, C. A., Sandoval-Reyes, J. O., Tecpoyotl-Torres, M., & Varona, J. (2019). A novel electrothermal compliance microgripper. *2019 IEEE. 2019 International Conference on Mechatronics, Electronics and Automotive Engineering (ICMEAE) (Mexico)*, Cuernavaca. (pp. 74-78). doi: 10.1109/ICMEAE.2019.00021. Conference Paper.

Jorge Varona Salazar

SNI Nivel I

DESIGN AND 3D PRINTED IMPLEMENTATION OF A MICROGRIPPER ACTUATED BY A PIEZOELECTRIC STACK

ABSTRACT. This article presents the design and implementation of a microgripper device actuated by a piezoelectric stack. In order to reduce fabrication costs, conventional piezoelectric buzzers are used that are easily found in the market at very low cost. Polylactic Acid (PLA) was chosen as the struc-

tural material for the design of the mechanisms of the microgripper, the choice of this material considerably reduces the total implementation cost. The originality of this work resides in the material used and in the stacked piezoelectric actuator. The main contribution is the demonstration of a design methodology that implements prototype compliance mechanisms at millimeter scale for validation purposes before proceeding to the fabrication in micrometric scale. Even so, the system in mm scale can also be used for micro-manipulation due to the range of its microgripper jaws' aperture and its reliability. ANSYS™ was used as the software tool for simulation. © 2019 IEEE.

Ferrara-Bello, C. A., Sandoval-Reyes, J. O., Vargas-Chable, P., Tecpoyotl-Torres, M., & Varona, J. (2019). Design and 3D printed implementation of a microgripper actuated by a piezoelectric stack. *2019 IEEE. 2019 International Conference on Mechatronics, Electronics and Automotive Engineering (ICMEAE) (Mexico)*, Cuernavaca. (pp. 62-67). doi: 10.1109/ICMEAE.2019.00019. Conference Paper.

Jorge Varona Salazar

SNI Nivel I

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MEMS-BASED MICRO-SCALE WIND TURBINES AS ENERGY HARVESTERS OF THE CONVECTIVE AIRFLOWS IN MICROELECTRONIC CIRCUITS

ABSTRACT. As an alternative to conventional batteries and other energy scavenging techniques, this paper introduces the idea of using micro-turbines to extract energy from wind forces at the microscale level and to supply power to battery-less microsystems. Fundamental research efforts on the design, fabrication, and test of micro-turbines with blade lengths of just 160 μm are presented in this paper along with analytical models and preliminary experimental results. The proof-of-concept prototypes presented herein were fabricated using a standard polysilicon surface micro-machining silicon technology (PolyMUMPs) and could effectively transform the kinetic energy of the available wind into a torque that might drive an electric generator or directly power supply a micro-mechanical system. Since conventional batteries do not scale-down well to the microscale, wind micro-turbines have the potential for becoming a practical alternative power source for microsystems, as well as for extending the operating range of devices running on batteries. © 2020 International Journal of Renewable Energy Research.

Varona, J., De Fazio, R., Velázquez, R., Giannoccaro, N. I., Carasco, M., & Visconti, P. (2020). MEMS-based micro-scale wind turbines as energy harvesters of the convective airflows in microelectronic circuits. *International Journal of Renewable Energy Research*, 10(3), 1213-1225. Article.

Ramiro Velázquez Guerrero

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10 CLOCK-PERIODS PIPELINED IMPLEMENTATION OF AES-128 ENCRYPTION-DECRYPTION ALGORITHM UP TO 28 GBIT/S REAL THROUGHPUT BY XILINX ZYNQ ULTRASCALE+ MPSOC ZCU102 PLATFORM

ABSTRACT. The security of communication and computer systems is an increasingly important issue, nowadays pervading all areas of human activity (e.g., credit cards, website encryption, medical data, etc.). Furthermore, the development of high-speed and light-weight implementations of the encryption algorithms is fundamental to improve and widespread their application in low-cost, low-power and portable systems. In this scientific article, a high-speed implementation of the AES-128 algorithm is reported, developed for a short-range and high-frequency communication system, called Wireless Connector; a Xilinx ZCU102 Field Programmable Gate Array (FPGA) platform represents the core of this communication system since manages all the base-band operations, including the encryption/decryption of the data packets. Specifically, a pipelined implementation of the Advanced Encryption Standard (AES) algorithm has been developed, allowing simultaneous processing of distinct rounds on multiple successive plaintext packets for each clock period and thus obtaining higher data throughput. The proposed encryption system supports 220 MHz maximum operating frequency, ensuring encryption and decryption times both equal to only 10 clock periods. Thanks to the pipelined approach and optimized solutions for the Substitute Bytes operation, the proposed implementation can process and provide the encrypted packets each clock period, thus obtaining a maximum data throughput higher than 28 Gbit/s. Also, the simulation results demonstrate that the proposed architecture is very efficient in using hardware resources, requiring only 1631 Configurable Logic Blocks (CLBs) for the encryption block and 3464 CLBs for the decryption one. © 2020 by the authors. Licensee MDPI, Basel, Switzerland.

Visconti P., Capoccia S., Venere E., Velázquez R., & de Fazio R. (2020). 10 clock-periods pipelined implementation of AES-128 encryption-decryption algorithm up to 28 gbit/s real throughput by xilinx Zynq ultrascale+ MP-SoC ZCU102 platform. *Electronics (Switzerland)*, 9(10), 1-30. doi: 10.3390/electronics9101665. Article.

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A MULTISENSOR DATA FUSION APPROACH FOR PREDICTING CONSUMER ACCEPTANCE OF FOOD PRODUCTS

ABSTRACT. Sensory experiences play an important role in consumer response, purchase decision, and fidelity towards food products. Consumer studies when launching new food products must incorporate physiological response assessment to be more precise and, thus, increase their chances of success in the market. This paper introduces a novel sensory analysis system that incorporates facial emotion recognition (FER), galvanic skin response (GSR), and cardiac pulse to determine consumer acceptance of food samples. Taste and smell experiments were conducted with 120 participants recording facial images, biometric signals, and reported liking when trying a set of pleasant and unpleasant flavors and odors. Data fusion and analysis by machine learning models allow predicting the acceptance elicited by the samples. Results confirm that FER alone is not sufficient to determine consumers' acceptance. However, when combined with GSR and, to a lesser extent, with pulse signals, acceptance prediction can be improved. This research targets predicting consumer's acceptance without the continuous use of liking scores. In addition, the findings of this work may be used to explore the relationships between facial expressions and physiological reactions for non-rational decision-making when interacting with new food products. © 2020 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<http://creativecommons.org/licenses/by/4.0/>).

Álvarez-Pato, V. M., Sánchez, C. N., Domínguez-Soberanes, J., Méndez-Pérez, D. E., & Velázquez, R. (2020). A multisensor data fusion approach for predicting consumer acceptance of food product. *Foods*, 9(6). doi: 10.3390/foods9060774. Article.

A NON-WSSUS CHANNEL SIMULATOR FOR V2X COMMUNICATION SYSTEMS

ABSTRACT. This paper presents a simulator of non-wide sense stationary uncorrelated scattering (non-WSSUS) multipath fading channels for the performance analysis of vehicle-to-everything (V2X) communication systems. The proposed simulator is constructed with the combination of the Monte Carlo and sum-of-cisoids (SOC) principles, and it is suitable for multicarrier transmission schemes such as those defined for dedicated short-range communications (DSRC) and cellular-based V2X (C-V2X) communications. The channel simulator provides an accurate and flexible solution to reproduce the time and frequency (TF) correlation properties of non-WSSUS vehicular channels under arbitrary isotropic and non-isotropic scattering conditions. Furthermore, the proposed simulator allows velocity variations and non-linear trajectories of the mobile stations (MSs). To demonstrate the practical value of the presented simulator, we evaluate the bit error rate (BER) performance of two channel estimation techniques that are considered for IEEE 802.11p transceivers, namely the least squares (LS) estimator and the spectral temporal averaging (STA) technique. The BER performance of both channel estimators was analyzed by considering three propagating scenarios for road safety applications. Our results show that the non-stationary characteristics of the vehicular multipath fading channel have nearly no effects on the LS estimator's BER performance. In contrast, the performance of the STA estimator is significantly affected by the channel's non-stationary characteristics. A variation of the original STA technique that applies only a temporal averaging is introduced in this work to improve the system's BER in non-WSSUS channels. © 2020 by the authors. Licensee MDPI, Basel, Switzerland.

Jaime-Rodríguez, J. J., Gómez-Vega, C. A., Gutiérrez, C. A., Luna-Rivera, J. M., Campos-Delgado, D. U., & Velázquez, R. (2020). A non-WSSUS channel simulator for V2X communication systems. *Electronics (Switzerland)*, 9(8): 1-26. doi: 10.3390/electronics9081190. Article.

AUTOMATIC STOMATAL SEGMENTATION BASED ON DELAUNAY-RAYLEIGH FREQUENCY DISTANCE

ABSTRACT. The CO₂ and water vapor exchange between leaf and atmosphere are relevant for plant physiology. This process is done through the stomata. These structures are fundamental in the study

of plants since their properties are linked to the evolutionary process of the plant, as well as its environmental and phytohormonal conditions. Stomatal detection is a complex task due to the noise and morphology of the microscopic images. Although in recent years segmentation algorithms have been developed that automate this process, they all use techniques that explore chromatic characteristics. This research explores a unique feature in plants, which corresponds to the stomatal spatial distribution within the leaf structure. Unlike segmentation techniques based on deep learning tools, we emphasize the search for an optimal threshold level, so that a high percentage of stomata can be detected, independent of the size and shape of the stomata. This last feature has not been reported in the literature, except for those results of geometric structure formation in the salt formation and other biological formations. © 2020 by the authors. Licensee MDPI, Basel, Switzerland.

Carrasco, M., Toledo, P. A., Velázquez, R., & Bruno, O. M. (2020). Automatic stomatal segmentation based on Delaunay-rayleigh frequency distance. *Plants*, 9(11), 1-17. doi: 10.3390/plants9111613. Article.

BRUSH-HOLDER INTEGRATED LOAD SENSOR PROTOTYPE FOR SAG GRINDING MILL MOTOR

ABSTRACT. One of the most widely used electro-mechanical systems in large-scale mining is the electric motor. This device is employed in practically every phase of production. For this reason, it needs to be inspected regularly to maintain maximum operability, thus avoiding unplanned stoppages. In order to identify potential faults, regular check-ups are performed to measure the internal parameters of the components, especially the brushes and brush-holders. Both components must be properly aligned and calibrated to avoid electric arcs to the internal insulation of the motor. Although there is an increasing effort to improve inspection tasks, most inspection procedures are manual, leading to unnecessary costs in inspection time, errors in data entry, and, in extreme cases, measurement errors. This research presents the design, development, and assessment of an integrated measurement prototype for measuring spring tension and other key parameters in brushholders used in electric motors. It aims to provide the mining industry with a new, fully automatic inspection system that will facilitate maintenance and checking. Our development research was carried out specifically on the brush system of a SAG grinding mill motor. These machines commonly use SIEMENS motors; how-

ever, the instrument can be easily adapted to any motor by simply changing the physical dimensions of the prototype. © 2019 by the authors. Licensee MDPI, Basel, Switzerland.

Carrasco, M., Álvarez, F., Velázquez, R., Concha, J., & Pérez-Cotapos, F. (2019). Brush-Holder Integrated Load Sensor Prototype for SAG Grinding Mill Motor. *Electronics (Switzerland)*, 8(11). doi: 10.3390/electronics8111227. Article.

Ramiro Velázquez Guerrero

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Ernesto Jonnatan Arroyo Pilatowsky

Profesor investigador

DESIGN AND IMPLEMENTATION OF A LOW-COST PRINTER HEAD FOR EMBOSSING BRAILLE DOTS ON PAPER

ABSTRACT. This paper presents the design, implementation, and prototype of a low-cost Braille embossing mechanism. The proposal is a printer head integrating three hammers that, upon actuation, stamp readable dots on the paper. Inspired in the rotary cam-follower mechanism, the hammers are actuated by a single servomotor which rotation determines which hammer strikes the paper. Braille characters can be quickly embossed using the proposed printer head. Affordable and efficient Braille embossers for home use can be envisaged using this new action approach. © 2020, World Academy of Research in Science and Engineering. All rights reserved.

Arroyo, J., Velázquez, R., Boukallel, M., Giannoccaro, N. I., & Visconti, P. (2020). Design and implementation of a low-cost printer head for embossing braille dots on paper. *International Journal of Emerging Trends in Engineering Research*, 8(9), 6183-6190. doi: 10.30534/ijeter/2020/206892020. Article.

Ramiro Velázquez Guerrero

SNI Nivel I

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Investigador Titular D, SNI Nivel I

USABILITY EVALUATION OF FOOT-BASED INTERFACES FOR BLIND TRAVELERS

ABSTRACT. Together with sight and hearing, touch represents a means of communication for human beings. Indeed, the sense of touch is capable of proving a whole non-verbal language that can be developed and offer many more possibilities than traditionally believed. Much of what is found in the literature about tactile communication concerns tactile stimulation of the fingertips and hands. However, as the area of tactile feedback is a 'hot' research topic especially in human-computer interaction, other body areas have been explored as well; wrist/forearm [1], abdomen [2], chest [3], tongue [4], ears [5], and head [6] have been studied to transmit information to a user (a comprehensive survey of wearable tactile devices can be found in [7]). Devices are as diverse as the technology used and the location on the body. Yet, the human foot has not received much attention.

Arroyo, J., Velázquez, R., Boukallel, M., Giannoccaro, N. I., & Visconti, P. (2020). Usability evaluation of foot-based interfaces for blind travelers. *IEEE Instrumentation & Measurement Magazine*, 23(4), 4-13. doi: 10.1109/MIM.2020.9126045. Article.

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