



Informe de Producción Científica 2021



UNIVERSIDAD
Panamericana





**Informe
de Producción
Científica 2021**



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Informe de Producción Científica 2021

Informe De Producción Científica 2021

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Presentación

La investigación que se genera en la Universidad Panamericana tiene siempre el objetivo de hacer aportaciones a los avances científicos del mundo y mejorar nuestra calidad docente; así como abonar en la solución de los retos que enfrenta hoy nuestro país.

Este año, estamos especialmente orgullosos de que, a pesar de las afectaciones que ha dejado la pandemia a nivel global y de los retos a los que nos hemos enfrentado como comunidad, no sólo hemos mantenido el crecimiento, liderazgo y la calidad de nuestras publicaciones, sino mejorado el reconocimiento, la visibilidad y los resultados de investigación de los últimos años.

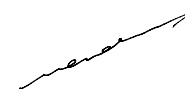
Gracias al esfuerzo de nuestros profesores, por ejemplo, que el 49% de nuestra producción científica de 2021, se encuentre publicada en revistas Q1 y Q2; donde la visibilidad de los resultados de investigación mejora sensiblemente. Es importante mencionar que con el avance logrado al día de hoy, seguimos siendo la segunda institución privada en México con el mayor volumen de producción científica indexada en Scopus.

Los siguientes pasos en la estrategia de investigación que se ha estado impulsando desde el Consejo de Rectoría, estarán encaminados a la identificación y consecución de fondos de financiamiento; así como a la puesta en marcha de un ecosistema de innovación y transferencia tecnológica, que nos permita completar el ciclo de la investigación aplicada, la sustentabilidad de los proyectos y su impacto económico y social.

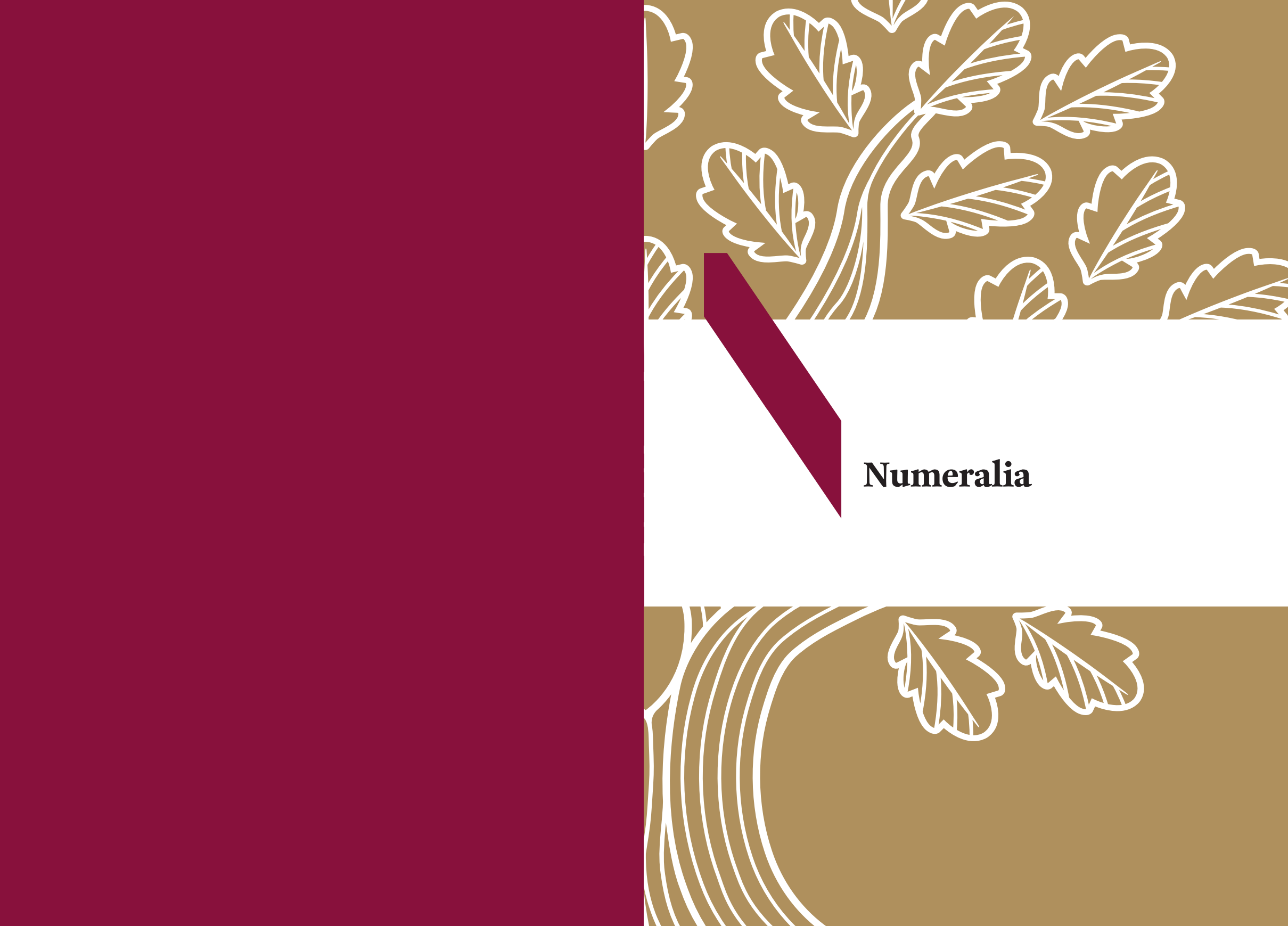
Aquí me gustaría reconocer el esfuerzo para llevar a cabo la primera convocatoria de Propiedad Intelectual, que no sólo tenía el objetivo de fomentar el tema de los derechos y beneficios que traen consigo las creaciones o innovaciones que se desarrollan en la Universidad, sino promover una cultura de transferencia que nos permita transitar de la teoría a la práctica con mayor naturalidad y sentido institucional.

La estrategia de innovación y transferencia estará dirigida por la recientemente creada Dirección Corporativa de Innovación y Transferencia, cuyo objetivo es conectar la generación de nuevo conocimiento con la creación de soluciones económicamente viables. Para ello, además de la construcción de políticas, nos apoyará con el desarrollo de programas en materia de propiedad intelectual y transferencia de conocimiento.

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

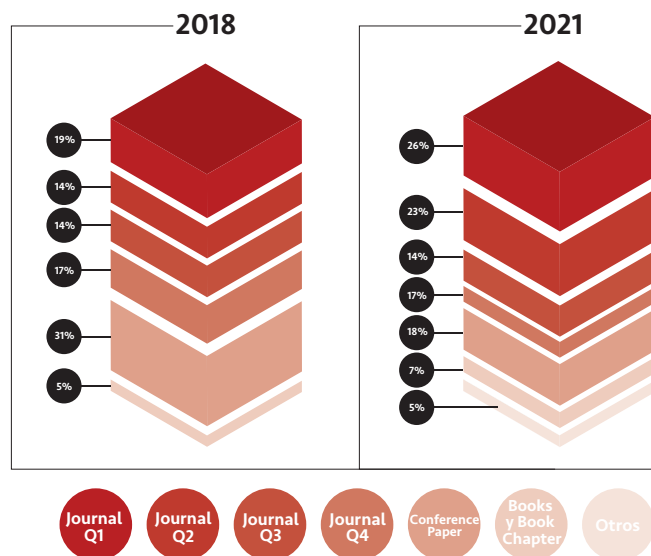


Dr. Abraham Mendoza Andrade
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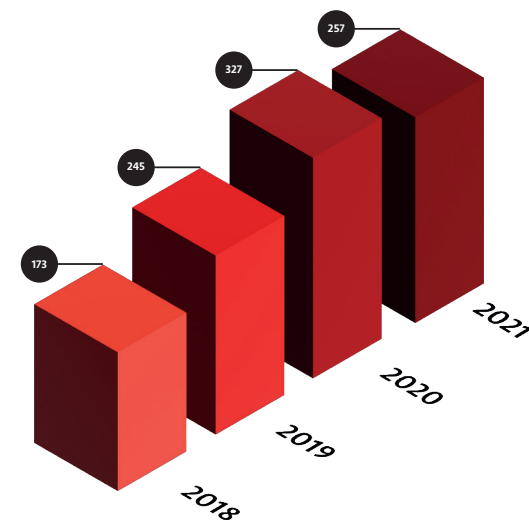


Numeralia

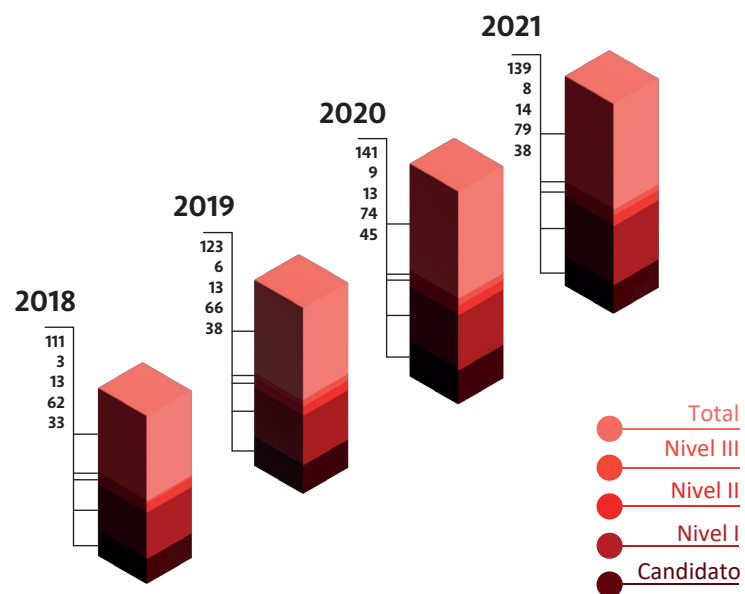
Calidad 2018 vs 2021



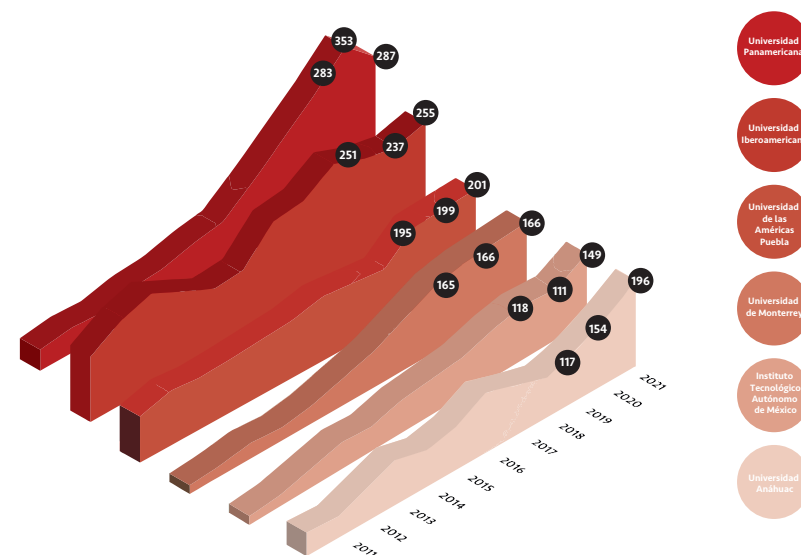
Publicaciones históricas IPC



Miembros del Sistema Nacional de Investigaciones



Benchmark universidades



Publicaciones anuales.

*Producción visible indexada solo en Scopus. (18 "Article in press" en el año 2021)

*Universidades privadas con menos de 1,000 publicaciones al año.





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Profesor investigador

DRUG TRAFFICKING IN MEXICAN CINEMA: ARCHETYPES FROM 2010 TO 2017

[EL NARCOTRÁFICO EN EL CINE MEXICANO: ARQUETIPOS DESDE 2010 A 2017]

ABSTRACT. This article studies the archetypes and the iconography in contemporary Mexican films that deal with drug trafficking in order to examine the evolution of the narco cinema subgenre and changes in the representation of the narcocultura. The corpus is constituted by the biggest box office hits each year between 2010 and 2017, which are analysed thematically. This study suggests that the characteristics of the narcocultura continue circulating within Mexican cinema, but it does not point to a subgenre's existence. The genres circumscribing the films analysed promote the narcos' heroism via archetypes and iconography, which symbolize how narcos overcome their *modus vivendi* to stand as a legitimate authority against a corrupt government. Alongside this representation of narcos, these films also present objectified women and promote values such as loyalty and family. The aforementioned archetypes and iconography offer a view of life in which violence is normalized, and crime is seen as a legitimate lifestyle. © 2021 Intellect Ltd Article.

Díaz-Cerveró, E. & Domínguez-Partida, G. (2021). Drug trafficking in Mexican cinema: Archetypes from 2010 to 2017 [El narcotráfico en el cine mexicano: Arquetipos desde 2010 a 2017]. *Studies in Spanish and Latin American Cinemas*, 18(2), 211-229. doi: 10.1386/slac_00047_1. Article.

Elba Díaz Cerveró

SNI Nivel I

HOW DO JOURNALISTS IN MEXICO REPORT ON ORGANISED CRIME: REPRESENTING THE FACTS, INTERPRETATION, AND SELF-CRITIQUE

[KAKO NOVINARI U MEKSIKU IZVJEŠTAJU O ORGANIZIRANOM KRIMINALU: PRIKAZIVANJE ČINJENICA, TUMAČENJE I SAMOKRITIKA]

ABSTRACT. Among the many outcomes of the so-called War on Drugs, Mexico has become one of the most dangerous countries in the world for journalism. Besides killings and kidnappings, journalists are also frequent victims of beatings, arbitrary detentions, and online harassment, as well as many other acts of aggression. Anti-press violence has an evident impact on Mexican journalists' daily

activities, particularly as related to the coverage of organised crime. The endemic risk that news workers constantly face determines how they represent and interpret the stories they report on when it comes to this issue. Thus, this inquiry aims to analyse the practices that reporters and editors implement during the news-making process when covering cartels' activities. In doing so, this paper draws on a set of in-depth interviews with news workers from Mexico's main national newspapers, and from all the states where journalists were killed in 2017. The main findings indicate that there is a lack of written norms for the coverage of organised crime, and that reporters refer to criminals with a sense of familiarity. In addition, this study contributes to the understanding of journalists' decisions in the field when doing their job, especially in dangerous conditions. © 2021 Doron Fakultet Politickih Znanosti. All rights reserved.

Díaz-Cerveró, E., Ibáñez, D. B., & Macías, R. A. G. (2021). How do journalists in Mexico report on organised crime: Representing the facts, interpretation, and self-critique [Kako novinari u Meksiku izvještavaju o organiziranom kriminalu: Prikazivanje činjenica, tumačenje i samokritika]. *Medijska Istraživanja*, 27(1), 49-73. doi: 10.22572/mi.27.1.3. Article.

Elba Díaz Cerveró

SNI Nivel I

REPORTING UNDER THREAT: VIOLENCE, PROFESSIONALIZATION, AND ERRATIC MODERNIZATION OF THE MEXICAN MEDIA SYSTEM

[REPORTEAR BAJO AMENAZA: VIOLENCIA, PROFESIONALIZACIÓN Y MODERNIZACIÓN IRREGULAR DEL SISTEMA MEDIÁTICO MEXICANO]

ABSTRACT. A media system deemed modern requires, among other things, the practice of free professional journalism, which has not been entirely possible in Mexico because the growing violence against journalists has emerged as one of the principal obstacles to their job. The aim is to describe Mexican journalists' responses to the relentless threats and attacks they face based on 93 semi-structured interviews conducted in 23 of the country's most violent states. Concerning journalism professionalization, the results suggest that violence against the media has two implications mainly. First, the attacks have favored the development of better journalistic practices, such as adherence to data and facts, diversification of information sources, deployment of collaborative coverage, and creation of journalist associations. Second, in a significant number of cases, violence has inhibited press freedom, promoting self-censorship or dependence on official government newsletters. The coexistence of both reactions reveals the fickle nature of the Mexican

media system and its modernization process. © 2021 Universidad de La Sabana. All rights reserved.

Macías, R. A. G., Díaz-Cerveró, E., & Barredo-Ibáñez, D. (2021). Reporting under threat: Violence, professionalization, and erratic modernization of the Mexican media system [Reportear bajo amenaza: violencia, profesionalización y modernización irregular del sistema mediático mexicano]. *Palabra Clave*, 24(1). Art. 11879. doi: 10.5294/PACLA.2021.24.1.1. Article.

Elba Díaz Cerveró

SNI Nivel I

Rafael Hurtado Domínguez

Profesor investigador

THE IMAGE OF THE FATHER IN DOWNTON ABBEY: MANIFESTATION OF IDENTITY IN VIRTUOUS ACTIONS

ABSTRACT. The British television series *Downton Abbey* (directed by Julian Fellowes) could be considered a media phenomenon without precedent. Since its release in 2010 and throughout its six seasons, it reached a global audience in over 220 countries. At a time when the father figure is dissolving, fading, or missing in the content of television series, the worldwide success of *Downton Abbey* features the image of Lord Robert Crawley (Hugh Bonneville), Earl of Grantham, the father of an aristocratic family in England. This article will analyze paternal image from its ontological and historical roots, considering truth, transcendence and goodness, as well as manifestations of paternal virtues. Given the fact that virtue is not easily measured, the analysis will show that a father's identity can be reflected in a series of virtuous actions, as manifestations of core virtues. These virtues are the basis for a quantitative content analysis of the seven episodes of the first season, through the application of a methodological tool for audiovisual analysis. © 2021 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group.

Díaz-Cerveró, E., Hurtado, R., & Crespo, M. G. (2021). The image of the father in *Downton Abbey*: manifestation of identity in virtuous actions. *Church, Communication and Culture*, 6(1), 34-57. doi: 10.1080/23753234.2021.1884818. Article.

Mariano Emmanuel Navarro Arroyo

Investigador Titular A, SNI Nivel Candidato

IMAGINATIVE COMMUNICATION AND COMMUNITY: THE PHENOMENOLOGICAL-ENACTIVE APPROACH TO THE CO-CONSTITUTION OF PUBLIC PHENOMENA

ABSTRACT. An ever-evolving phenomenological-enactive perspective can expand our reflection on the

entanglement between enactive subjects and their living ecologies. This article applies certain classical phenomenological projects and their enactive extension to public phenomena (objects, spaces, events, etc.). As an instance of the embodied cognition discourse, this research also aims to thematize the enactive, affective, and intersubjective aspects of the relation to the (urban) *Lebenswelt*. This may help in understanding both the potential of the phenomenological-enactive methodology and the processes of an embodied intersubjective co-constitution of a public ethos. Theoretical ideas presented in the article are illustrated with reflections on some concrete public phenomena. © 2021 SUBB Philosophia.

Briedis, M. & Navarro, M. (2021). Imaginative communication and community: The phenomenological-enactive approach to the co-constitution of public phenomena. *Studia Universitatis Babeş-Bolyai Biologia*, 66(3), 181-192. doi: 10.24193/subbphil.2021.3.08. Article.

Josefina del Carmen Santana Villegas

Investigadora Titular D, SNI Nivel I

A QUALITATIVE LOOK AT TEST ANXIETY AND ENGLISH LANGUAGE PROFICIENCY TESTS

ABSTRACT. Test anxiety is an emotional response to a testing situation. This article reports on the qualitative aspects of a study carried out at a Mexican university. Students are required to complete an English language proficiency test in order to graduate from their studies. A large percentage of students at this university have studied at bilingual (English-Spanish) schools, or have had access to study abroad programs, and are proficient in the spoken language; however, this does not guarantee that they pass the test. The researchers looked into possible factors for some students' failure to obtain the required score, despite their proficiency. These factors included test anxiety, self-efficacy, self-awareness, and lack of motivation. This article reports on a study into test anxiety which included both quantitative and qualitative aspects. The qualitative portion of the study sought to understand the participants' experience in taking the exam in regards to test anxiety. Seven students from the school of Pedagogy were interviewed after they had failed to pass a Test of English for International Communication (TOEIC). Thematic analysis was used to find their common experiences, with a goal to offer an intervention or solution. The study found that factors other than test anxiety, such as lack of preparedness, might be at play. Based on the findings, pertinent intervention strategies were suggested. ©Common Ground Research Networks.

Santana, J. C. & Michel, K. M. V. (2020). A Qualitative Look at Test Anxiety and English Language Proficiency Tests. *International Journal of Assessment and Evaluation*, 27(2), 15-29. doi: 10.18848/2327-7920/CGP/v27i02/15-29. Article.

Josefina del Carmen Santana Villegas

Investigadora Titular D, SNI Nivel I

DO CORONAVIRUS CONFINEMENT MEASURES CAUSE ANXIETY, STRESS AND DEPRESSION IN UNIVERSITY STUDENTS?

ABSTRACT. Though Coronavirus disease (COVID-19) is not a disease that directly affects people's minds, the confinement measures intended to prevent its spread have been taking a toll on mental health. The objective of this study is to evaluate the level of anxiety, stress and depression in university students of the Middle Zone Multidisciplinary Academic Unit of the Autonomous University of San Luis Potosí during the confinement caused by the presence of COVID 19 and to evaluate if these levels are different in men and women. The sample consisted of 180 university students enrolled in the semester between January and May 2020. The short version of the 21-item DASS questionnaire was used. The results give evidence that the level of depression, anxiety and stress in these university students is not high and there is not enough evidence to say that there is a difference between the level of depression, anxiety and stress in women and men. © 2021 The Author(s). Open Access - This article is under the CC BY license (<https://creativecommons.org/licenses/by/4.0/>).

Escalera-Chávez, M. E., Santana, J. C., & García-Santillán, A. (2021). Do coronavirus confinement measures cause anxiety, stress and depression in university students? *European Journal of Educational Research*, 10(2), 855-864. doi: 10.12973/EU-JER.10.2.855. Article.

Josefina del Carmen Santana Villegas

Investigadora Titular D, SNI Nivel I

EDUCATION AND ECOTOURISM

ABSTRACT. Early cultures in human history used nature as a source of food, tools, habitat, shelter, clothing, etc. After these basic needs for food, housing and clothing were fulfilled, humans acquired an interest in nature: in its intrinsic value. This interest became evident by early pictographic paintings on rocks at several locations worldwide and early art manifestations. Later on, cultures such as the Babylonians, Egyptians and Greeks applied observation to delve into the natural world. The observation of nature provided the first tool to establish a link between humans and nature.

Ramírez, F. & Santana, J. (2019). Education and Ecotourism. In F. Ramírez & J. Santana (coords), *Environmental Education and Ecotourism* (pp. 21-25). Springer. doi: 10.1007/978-3-030-01968-6_4. Book Chapter.

Josefina del Carmen Santana Villegas

Investigadora Titular D, SNI Nivel I

ENVIRONMENTAL EDUCATION AND BIODIVERSITY CONSERVATION

ABSTRACT. The term *biodiversity* refers to the wealth of life on Earth. Because environmental problems tend to be based on lack of knowledge and education, promoting biodiversity conservation is an important role of education worldwide.

Ramírez, F. & Santana, J. (2019). Environmental Education and Biodiversity Conservation. In F. Ramírez & J. Santana (coords), *Environmental Education and Ecotourism* (pp. 7-11). Springer. doi: 10.1007/978-3-030-01968-6_2. Book Chapter.

Josefina del Carmen Santana Villegas

Investigadora Titular D, SNI Nivel I

ENVIRONMENTAL EDUCATION AND ECOTOURISM: CONCLUSION

ABSTRACT. This book has covered diverse aspects related to ecotourism and environmental education, among them, the role of education in biodiversity conservation. Over the last 25 years, nations around the world have recognised the importance of preserving different animal and plant species. The United Nations Organization has established biodiversity conservation as one of its major goals for the next decades, and has emphasised the importance of education in accomplishing this goal, by focusing on education for sustainable development, increasing public awareness, and training the Indigenous populations to monitor and manage natural resources. Examples from different parts of the world have shown how the goal is being accomplished.

Ramírez, F. & Santana, J. (2019). Environmental Education and Ecotourism Conclusion. In F. Ramírez & J. Santana (coords), *Environmental Education and Ecotourism* (pp. 57-59). Springer. doi: 10.1007/978-3-030-01968-6_10. Book Chapter.

Josefina del Carmen Santana Villegas

Investigadora Titular D, SNI Nivel I

ENVIRONMENTAL EDUCATION AND ECOTOURISM: INTRODUCTION

ABSTRACT. Worldwide ecotourism has become a new perspective for integrating nature, culture, and the tourism sector. Though ecotourism has been touted as a "green" –that is, ecologically sound– form of tourism, it can paradoxically lead to the degradation of the sites it seeks to protect.

Ramírez, F. & Santana, J. (2019). Environmental Education and Ecotourism Introduction. In F. Ramírez & J. Santana (coords), *Environmental Education and Ecotourism* (pp. 1-5). Springer. doi: 10.1007/978-3-030-01968-6_1. Book Chapter.

Josefina del Carmen Santana Villegas

Investigadora Titular D, SNI Nivel I

ENVIRONMENTAL EDUCATION AND ECOTOURISM: PREFACE

ABSTRACT. Ecotourism is an important field of tourism that has bridged environmentally friendly practices and the tourism industry worldwide. Today, ecotourism has become an important revenue sector for stakeholders and communities. It has provided numerous solutions as a suitable tourism type, but has also caused environmental impacts. Recently, ecotourism has become important in developing countries offering a sustainable practice i.e. ecologically-friendly minimizing the impacts caused by other tourism practices. Education is a key aspect for ecotourism because it has provided a dialogue between communities, stakeholders, researchers, citizens and eco-tourists. Education has provided a framework for any ecotourism practice, because it encourages the basic know how and principles for a environmentally friendly practice. Education is a core aspect in ecotourism because it can provide the necessary momentum to encourage the common citizen to become aware of ecotourism practices and perform responsible ecotourism. This SpringerBrief focuses on the principles of ecotourism such as relevance of the field, origin, fundamental aspects, definitions, philosophy, implications in biodiversity conservation and environmental impacts. Special emphasis is also given to the interaction between ecotourism and education and it is supported by recent publications from the authors.

Ramírez, F. & Santana, J. (2019). Environmental Education and Ecotourism Preface. In F. Ramírez & J. Santana (coords), *Environmental Education and Ecotourism* (pp. VII-VII). Springer. Book Chapter.

Josefina del Carmen Santana Villegas

Investigadora Titular D, SNI Nivel I

ENVIRONMENTAL IMPACT

ABSTRACT. Ecotourism represents one of the more eco-friendly alternatives for the economic use of natural resources (Li 2004). The core basis of the field of ecotourism is deeply connected to environmental issues. Other tourism forms are less involved with caring for the environment. Although, the eco-

tourism sector has principles that pertain to nature, such as environmental conservation, a number of impacts have been generated as a result of human activities in nature-based destinations.

Ramírez, F. & Santana, J. (2019). Environmental Impact. In F. Ramírez & J. Santana (coords), *Environmental Education and Ecotourism* (pp. 45-49). Springer. doi: 10.1007/978-3-030-01968-6_8. Book Chapter.

Josefina del Carmen Santana Villegas

Investigadora Titular D, SNI Nivel I

INDIGENOUS ECOTOURISM

ABSTRACT. Native cultures can benefit from ecotourism. However, this can be controversial and is often dependent of the type of target culture. Some cultural groups feel that Western civilization is often invasive, threatening their beliefs, and ways of life. For example, the Indigenous people from Sierra Nevada de Santa Marta in Colombia feel that Westerners are invasive and avoid contact with *blancos* white men (Ramírez personal observation). On the other hand, other cultures are open to western thought, and feel cultural exchange is fundamental for integrating culture on a global context.

Ramírez, F. & Santana, J. (2019). Indigenous Ecotourism. In F. Ramírez & J. Santana (coords), *Environmental Education and Ecotourism* (pp. 39-43). Springer. doi: 10.1007/978-3-030-01968-6_7. Book Chapter.

Josefina del Carmen Santana Villegas

Investigadora Titular D, SNI Nivel I

NATIONAL PARKS AND BIODIVERSITY CONSERVATION

ABSTRACT. Protected areas have been considered important sites for biodiversity conservation. These areas are considered as the last sanctuaries for endangered and vulnerable species worldwide (Fig. 6.1). Protected areas cover around 15.4 % of the world's land area and 3.4 % of the global ocean area (UNEP 2015). The 2014 United Nations List of Protected Areas covers information of over 209,000 protected areas, from 193 countries, covering more than 32 million km² and distributed within 11 regions: areas beyond National jurisdiction, Africa, Asia, Caribbean, Central America, Europe, Middle East, North America, Oceania, South America and Southern Oceans (Deguignet et al. 2014).

Ramírez, F. & Santana, J. (2019). National Parks and Biodiversity Conservation. In F. Ramírez & J. Santana (coords), *Environmental Education and Ecotourism* (pp. 33-38). Springer. doi: 10.1007/978-3-030-01968-6_6. Book Chapter.

Josefina del Carmen Santana Villegas

Investigadora Titular D, SNI Nivel I

PHILOSOPHY OF ECOTOURISM

ABSTRACT. The philosophy of ecotourism has been examined by several authors, including Neil (Ecotourism: impacts, potentials and possibilities. Reed Educational and Professional Publishing Ltd. Boston, 1999) and Fennell (Aristotle and the science of nature: unity without uniformity. Cambridge University Press, Cambridge, 2002). Ecotourism philosophy is dominated by Western thought, thus many valuable lessons can only be learned by deconstructing its meaning to find application in various socio-cultural contexts (Nowaczek et al. in Critical issues in ecotourism: understanding a complex tourism phenomenon. Elsevier, Amsterdam, 2007). In the West, perceptions of ecotourism and national parks are influenced by historico-philosophical attitudes to wilderness and nature (Cochrane in Critical issues in ecotourism: understanding a complex tourism phenomenon. Elsevier, Amsterdam, pp 287-307, 2007).

Ramírez, F. & Santana, J. (2019). Philosophy of Ecotourism. In F. Ramírez & J. Santana (coords), *Environmental Education and Ecotourism* (pp. 27-31). Springer. doi: 10.1007/978-3-030-01968-6_5. Book Chapter.

Josefina del Carmen Santana Villegas

Investigadora Titular D, SNI Nivel I

RELEVANCE OF ECOTOURISM

ABSTRACT. Today's globalized world has an overproduction of goods and services. The tourism sector offers multiple destinations, tours and attractions. In consequence, this has caused major environmental problems, i.e., sewage, garbage, land use, reduction in forest cover, coastal modification, habitat loss for many species, etc. Today, ecotourism has provided a better way to manage resources and offers an environmentally-based ideology. Also, it proposes important links between conservation and restoration.

Ramírez, F. & Santana, J. (2019). Relevance of Ecotourism. In F. Ramírez & J. Santana (coords), *Environmental Education and Ecotourism* (pp. 13-20). Springer. doi: 10.1007/978-3-030-01968-6_3. Book Chapter.

Josefina del Carmen Santana Villegas

Investigadora Titular D, SNI Nivel I

WETLAND ECOTOURISM

ABSTRACT. Wetlands are important ecosystems worldwide that have provided a number of ecosys-

tems services. Ecosystem services are a wide range of social, economic, cultural, and environmental benefits that people receive from ecosystems (Costanza et al. in Nature 387: 253-260, 1997). Wetlands provide a number of ecosystem services such as maintaining water quality and supply, decreasing suspended matter, regulating atmospheric gases, sequestering carbon, regulating water regimes, retaining pollutants, sustaining unique indigenous biota, protecting shorelines, and providing recreational, cultural and educational resources (Dise in Science 326:810-811, 2009; Haslam et al. in The production ecology of wetlands: the IBP synthesis. Cambridge University Press, Cambridge, pp 405-464, 2009). Also, wetlands are considered rich in biodiversity and are among the most vulnerable and sensitive ecosystems (Sardon in Sustaining the world's wetlands setting policy and resolving conflicts. Springer, New York, 2009).

Ramírez, F. & Santana, J. (2019). Wetland Ecotourism. In F. Ramírez & J. Santana (coords), *Environmental Education and Ecotourism* (pp. 51-56). Springer. doi: 10.1007/978-3-030-01968-6_9. Book Chapter.

María Fernanda Vidal Correa

SNI Nivel I

TRANSITIONING FROM DESCRIPTIVE TO SUBSTANTIVE REPRESENTATION: A STUDY OF THE MEXICAN CONGRESS

ABSTRACT. The increasing number of women in the Mexican Congress could lead us to expect that women's interests are being better represented. However, there is no sufficient recent evidence on a correlation between a more robust descriptive representation and women's substantive representation in Mexico. Has the increase in the number of women led to greater focus on women's issues? Are the contents of bills sponsored in fact representing women? The objective of this paper is to address the links between women's increasing descriptive representation and the substantive representation of this group. To this end, a sample of legislative bills of the Mexican Chamber of Deputies, authored between 2015 and 2019, are assessed. Evidence points towards a change in the legislative work, embracing women's issues, as more women are elected. Issues raised include those related to gender violence, including various forms of classification of crimes. They also highlight the reforms that push parity in the composition of various governing bodies, including the Supreme Court of Justice. Legislation is pushing to close the gender pay gap, and to mandate government institutions to include a gender perspective in all of their processes. But

even if the substantive representation of some types of women has improved, major breakthroughs through legislation are seldom achieved due to conservative conceptualizations of women's roles. © 2020 Institute of Political Studies. All rights reserved.

Vidal-Correa, F. (2021). Transitioning from descriptive to substantive representation: A study of the Mexican congress. *Acta Politologica*, 12(3), 27-50. doi: 10.14712/1803-8220/7_2020. Review.

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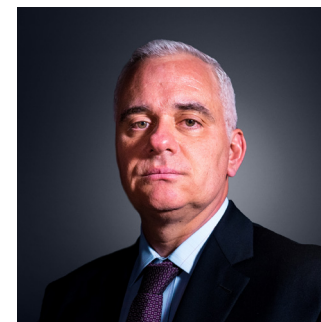
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* Colaboración en el artículo " BIOPOLYMERS OBTAINED FROM ORANGE WASTE BASED ON A DECISION TREE " de la Corresponding Author Pia Berger, publicado en Facultad de Ingeniería (p.99)





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**THE EFFECT OF A FREE TRADE AGREEMENT
WITH THE UNITED STATES ON MEMBER
COUNTRIES' PER CAPITA GDP: A SYNTHETIC
CONTROL ANALYSIS**

ABSTRACT. This study employs the synthetic control method (SCM) to estimate the economic effects of signing free trade agreements (FTAs) with the United States. This method allows for a counterfactual –the country's per capita GDP had it not signed a FTA–, which can be compared with the observed per capita GDP. This difference speaks to the causal impact of the FTA. We principally find that FTAs seem to have a heterogeneous impact. In particular, there is evidence that signing a FTA with the U.S. had a positive impact on Chile and Jordan's per capita GDP and that NAFTA harmed Mexico's per capita GDP. In several other cases, no significant economic impact is discernible. Besides, the more a country depends on the U.S. for its trade, the less beneficial signing a FTA with the U.S. is. This article contributes to the debate on the effectiveness of trade as a development strategy. In particular, the SCM opens up the possibility of a “case-by-case” analysis, ultimately revealing that a FTA with the U.S.–a country situated at the world's technology frontier–has heterogeneous outcomes and, by itself, does not guarantee economic development (obtained through a higher per capita GDP). © 2021 The Author(s). *Regional Science Policy and Practice* © 2021 Regional Science Association International

Colla-De-Robertis, E. & Garduno Rivera, R. (2021). The effect of a free trade agreement with the United States on member countries' per capita GDP: A synthetic control analysis. *Regional Science Policy and Practice*, 13(4), 1129-1145. doi: 10.1111/rsp3.12402. Article.



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DIGITAL TOOLS FOR VIRTUAL COURSES FOR UNIVERSITY TEACHERS AFFECTED BY COVID-19

ABSTRACT. Due to the 2020 scenario, the pandemic caused by the COVID-19 virus prompted a substantial change in the methods used by teachers when teaching and implementing their classes. As a support mechanism for teachers in the face of the radical change from physical presence to virtual presence, two courses were designed by the School of Pedagogy of the Universidad Panamericana: the first on Instructional Design and the second on didactic tools that enhance interaction and revitalization of classes. The summer of 2020 was the ideal time to train and prepare teachers in the instructional design of online classes because, although the educational model of the university is face-to-face, the circumstances and health limitations forced a strategic change to carry on with the quality that characterizes the institution. The preliminary results that we analyze with the SPSS software indicate that for 90.5% of the teachers the content of the course contributed to their professional development and that 87.2% have sufficient elements to redesign their subject for the following semester, which is executed in virtual mode. © 2020 IEEE.

De La Serna-Tuya, A. S., Salgado-Gutierrez, D., Ochoa-García, J., Mora-Lopez, A. F., & García-Bejar, L. (2020). Digital Tools for virtual courses for university teachers affected by COVID-19. 10th International Conference on Virtual Campus, Tetouan, Morocco. *JICV, 2020*. Art. 9375698. doi: 10.1109/JICV51605.2020.9375698. Conference Paper.

Ligia García Béjar
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WHY DO THOSE WHO WATCH NETFLIX WATCH NETFLIX? ENGAGEMENT EXPERIENCES OF YOUNG MEXICANS FACING THE ONE WHO REVOLUTIONIZED AUDIOVISUAL CONSUMPTION

[¿POR QUÉ VEN NETFLIX QUIENES VEN NETFLIX?: EXPERIENCIAS DE ENGAGEMENT DE JÓVENES MEXICANOS FRENTE A QUIEN REVOLUCIONÓ EL CONSUMO AUDIOVISUAL]

ABSTRACT. The massification of streaming platforms, specifically Netflix, has modified the consumption

patterns of an increasingly active and empowered audience when it comes to choosing how, when and what content to watch. This behavioral pattern has generated the exploration of new mechanisms to know in greater detail and depth the motivations and emotions that people have when they face audiovisual content and platforms. The measurement of engagement offers adequate information to predict those behaviors that condition consumption, as well as some characteristics that cause loyalty to a brand and willingness to pay for a service. This paper describes, through a quantitative factor analysis, the engagement experiences that 574 Mexican millennials have when using Netflix. It was established that when using Netflix, experiences related to socialization, entertainment and reflection on new topics stand out. This would indicate that beyond entertainment, it generates other types of attributes that are typically associated with it. © 2021 University of Piura. All rights reserved.

Benavides Almarza, C. F. & García-Béjar, L. (2021). Why do those who watch Netflix watch Netflix? Engagement experiences of young Mexicans facing the one who revolutionized audiovisual consumption [¿Por qué ven Netflix quienes ven Netflix?: Experiencias de engagement de jóvenes mexicanos frente a quien revolucionó el consumo audiovisual]. *Revista de Comunicación, 20*(1), 29-47. doi: 10.26441/RC20.1-2021-A2. Article.

Julián Ochoa García
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Humberto Martínez Camacho
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THE ROLE OF THE PENITENTIARY LIBRARY IN THE SOCIAL REHABILITATION OF INMATES OF THE "PUENTE GRANDE" PENITENTIARY COMPLEX, JALISCO, MEXICO

[LA FUNCIÓN DE LA BIBLIOTECA PENITENCIARIA EN LA REINSERCIÓN SOCIAL DE LOS INTERNOS DEL COMPLEJO PENITENCIARIO PUENTE GRANDE, JALISCO, MÉXICO]

ABSTRACT. This work analyzes the influence that libraries have within penitentiary centers in relation to the social rehabilitation of their inmates from the perspective of those responsible for libraries or reading spaces within the prisons that compose the "Puente Grande" Penitentiary Complex, in the State of Jalisco, Mexico, carrying out a questionnaire that was applied to those in charge of the libraries in the four centers that are part of this complex, in which the library concept and its influence on social readaptation from a qualitative

perspective, the analysis of the services provided and, finally, the care and training of users. Among the main results, the following are highlighted: 1) the importance of reading and training activities as an instrument for social reinsertion, 2) the lack of professional training for those in charge, of the libraries 3) the deficiency in terms of physical and technological resources. © 2020, Informacion, Cultura y Sociedad. All Rights Reserved.

Ochoa-García J. & Martínez-Camacho H. (2020). The role of the penitentiary library in the social rehabilitation of inmates of the "Puente Grande" Penitentiary Complex, Jalisco, Mexico [La función de la biblioteca penitenciaria en la reinserción social de los internos del Complejo Penitenciario Puente Grande, Jalisco, México]. *Información, Cultura y Sociedad, 43*, 161-176. doi: 10.34096/ICS.143.8063. Article.

Rodrigo Sosa Sánchez
SNI Nivel I

THE ROLE OF THE LATERAL HABENULA IN INHIBITORY LEARNING FROM REWARD OMISSION

ABSTRACT. The lateral habenula (LHb) is a phylogenetically primitive brain structure that plays a key role in learning to inhibit distinct responses to specific stimuli. This structure is activated by primary aversive stimuli, cues predicting an imminent aversive event, unexpected reward omissions, and cues associated with the omission of an expected reward. The most widely described physiological effect of LHb activation is acutely suppressing mid-brain dopaminergic signaling. However, recent studies have identified multiple means by which the LHb promotes this effect as well as other mechanisms of action. These findings reveal the complex nature of LHb circuitry. The present paper reviews the role of this structure in learning from reward omission. We approach this topic from the perspective of computational models of behavioral change that account for inhibitory learning to frame key findings. Such findings are drawn from recent behavioral neuroscience studies that use novel brain imaging, stimulation, ablation, and reversible inactivation techniques. Further research and conceptual work are needed to clarify the nature of the mechanisms related to updating motivated behavior in which the LHb is involved. As yet, there is little understanding of whether such mechanisms are parallel or complementary to the well-known modulatory function of the more recently evolved prefrontal cortex. © 2021 Sosa et al.

Sosa, R., Mata-Luévanos, J., & Buenrostro-Jáuregui, M. (2021). The role of the lateral habenula in inhibitory learning from reward omission. *eNeuro, 8*(3). Art. eNeuro.0016-21.2021. doi: 10.1523/ENEURO.0016-21.2021. Article.

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UNSAFE FOOD HANDLING AND PREPARATION IN POOR HOUSEHOLDS

ABSTRACT. Traditionally, the home has been regarded as a place of wellbeing; however, the unsanitary handling of foodstuffs can endanger its occupants' health. This research aims to determine which high-risk practices occur in the homes of ten families suffering from food poverty. Checklists, field observations, and semi-structured interviews were used to investigate how they purchase, prepare, store, and eat their food. The most widespread, high-risk practice consisted of leaving food unrefrigerated for long periods of time due to punishing work schedules that compel working women to either cook early in the morning or late at night. Additionally, not all women wash their hands properly before handling food and neither do they follow correct procedures when disinfecting fruits and vegetables. Finally, a considerable risk of cross-contamination exists because of an unsanitary handling of raw meat and the use of a single dishcloth for most kitchen cleaning needs. An awareness of these practices will inform the design of teaching materials and courses aimed at safeguarding both health and wellbeing in the homes. Further research will focus on monitoring the effectiveness of this intervention.

Greaves-Fernandez, N. & Rabiela-Sotelo, M. D. (2020). Unsafe food handling and preparation in poor households. In M. G. Abdelmonem & A. Argandoña (eds.), *People, Care and Work in the Home* (pp. 58-77). Routledge. Book Chapter.

Ana Gabriela Ramírez Gutiérrez

SNI Nivel Candidato

A METHODOLOGICAL PROPOSAL FOR THE COMPLEMENTARITY OF THE SSM AND THE VSM FOR THE ANALYSIS OF VIABILITY IN ORGANIZATIONS

ABSTRACT. This paper presents a protocol that establishes the complementarity between Soft Systems Methodology (SSM) and the Viable System Model (VSM) for the analysis of viability in organizations. Various studies demonstrate the advantages of both hard and soft multimethodologies, especially in the field of operational research (OR). Relying on a literature review of multimethodology, the present research specifically focuses on papers that examine the resolution of problem sit-

uations in organizations using SSM and VSM. It subsequently addresses approaches to both methodologies and, as a result, presents the characteristics that favor complementarity. Thus, this research primarily contributes with a methodological proposal that integrates both SSM and VSM. In terms of its technical-methodological approach, this study proposes a comprehensive protocol for the integration of SSM and VSM. While some studies do extol the benefits of combining the two methodologies, a systematic protocol for their integration is still lacking. As such, the protocol presented herein consists of six steps used to diagnose or design a viable organization that includes a questionnaire for detecting organizational pathologies. © 2020, Springer Science+Business Media, LLC, part of Springer Nature.

Ramírez-Gutiérrez, A. G., Cardoso-Castro, P. P. & Tejada-Padilla, R. (2020). A Methodological Proposal for the Complementarity of the SSM and the VSM for the Analysis of Viability in Organizations. *Systemic Practice and Action Research*, 34(3), 331-357. doi: 10.1007/s11213-020-09536-7. Article.

Ana Gabriela Ramírez Gutiérrez

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OPTIMIZING A SOFTWARE-DEFINED NETWORK USING THE PEANO CURVE L-SYSTEM

[OPTIMIZACIÓN DE UNA RED DEFINIDA POR SOFTWARE BASADA EN LA CONSTRUCCIÓN DEL FRACAL DE PEANO]

ABSTRACT. At the present, millions of Microcontroller Units (MCU) are connected simultaneously in a digitally way to be our life more comfortable. These MCU not only interact with us turning on lights or identifying movement in a House but also they perform small and specific tasks such as sensing different parameters such as temperature, humidity, CO₂, adjustment of the environmental lights. There is a huge kind of these MCU called small general purpose devices, ESP8266 or RaspberryPi3 or any kind of Internet of Things (IoT) devices, which are connected to internet by means of a central node for sharing their information. The main goal of this article is to design a decentralized IoT network topology in order to connect all the MCU or nodes, based on the fractal Peano, i.e., without using a central one, just sharing some parameters with two adjacent nodes, taking into account that any member of these nodes knows the parameters of the rest of these devices even if they are not adjacent nodes. Specifically, with the proposed network we can access to the entire IoT network in real time in a dynamic way since the topology of the network can be adapted and reconfigured when a new node

is added using tools of Artificial Intelligence for its application in a Smart City. This proposal allows to save energy, increasing the time of life of the IoT network, when more wireless small-devices are connected and sensing parameters. © 2021 Instituto Politécnico Nacional. All rights reserved.

Matamoras, O. M., Escobar, J. J. M., Padilla, R. T., Gutierrez, A. G. R., & Jimenez, P. F. (2021). Optimizing a software-defined network using the peano curve l-system [Optimización de una red definida por software basada en la construcción del fractal de Peano]. *Computación y Sistemas*, 25(1), 33-45. doi: 10.13053/CYS-25-1-3319. Article.

Rosa Adriana Vázquez Gómez

Profesora investigadora

TOURISM TRAVEL PATTERNS AND MEXICAN MILLENNIAL WOMEN: A COMPARATIVE STUDY OF THEIR CONDITIONS AND MEANINGS

ABSTRACT. This paper presents a comparative study of the living conditions, practices and meanings of tourist travel for young millennial women in Mexico City's metropolitan area within the framework of youth tourism in order to identify how travel contributes to the social construction of their identity. Through comparative, mixed and gendered research, a methodological convergence strategy was applied in which quantitative research was carried out through surveys and qualitative research through interviews, aimed at two groups of young female students in different educational institutions, with different economic situations, and located in a central area vs. the outskirts of Mexico City. The results reveal similarities in both groups' travel practices, but there are differences with respect to the meanings they grant them and, therefore, the role that travel has in constructing their identities. Copyright © 2021 Inderscience Enterprises Ltd.

Gómez, R. A. V., García, M. O. & Mejía, D. A. O. (2021). Tourism travel patterns and Mexican millennial women: A comparative study of their conditions and meanings. *International Journal of Tourism Anthropology*, 8(2), 107-128. doi: 10.1504/IJTA.2021.116090. Article.

Friné Velázquez Contreras

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EFFECT OF PLA ACTIVE PACKAGING CONTAINING MONOTERPENE-CYCLODEXTRIN COMPLEXES ON BERRIES PRESERVATION

ABSTRACT. Blackberries and raspberries are highly perishable and fragile products, which limits their shelf life. The effect of biodegradable active pack-

aging of blackberries and raspberries containing 2.5% and 5.0% weight (wt%) of thymol or carvacrol complexed in β -cyclodextrins (β -CDs), successfully added to poly(lactic acid) (PLA), and melt-processed by injection molding was evaluated under stored conditions at 4 °C for 21 days, using as reference commercial clamshell and PLA package control samples. Thus, physicochemical, headspace, microbiological, and sensory quality studies were carried out in order to compare the efficacy of the different packages. Concerning weight loss, color, and total phenolic and soluble solids content, significant differences were detected when compared with commercial clamshell packaging. The results show that the PLA packages containing thymol and carvacrol complexes maintained the color, weight, and phenolic content of berries until day 21, with a score up to 45% better compared to commercial clamshell. The headspace analysis detected 101 mg L⁻¹ (ppm) of thymol and 35 ppm of carvacrol on the first day of refrigeration; these concentrations decreased with time. This release mechanism of carvacrol and thymol into the PLA package modified the initial atmosphere composition. After 21 days of storage, the berries had 4.25 degrees of acceptance, without adverse perception of aroma or flavor for both carvacrol and thymol compounds. A general microbial inhibition was observed for yeast and molds, which increased with the concentration of monoterpene in PLA packages, and showed an inhibition of 3.5 log units for PLA packages containing thymol, and of 3 log units for those containing carvacrol. Overall results show that PLA/ β -CD-thymol 5.0% packages prolonged raspberries' and blackberries' shelf life by one more week at 4 °C, compared with commercial clamshell packaging. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

Velázquez-Contreras, F., García-Caldera, N. de la Rosa J. D. P., Martínez-Romero, D., Núñez-Delgado, E., & Gabaldón, J. A. (2021). Effect of pla active packaging containing monoterpene-cyclodextrin complexes on berries preservation. *Polymers*, 13(9). Art. 1399. doi: 10.3390/polym13091399. Article.



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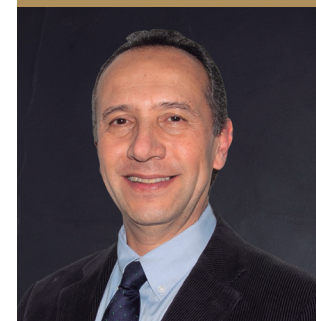
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Evandro Agazzi

SNI Nivel III

THE MULTIPLE ASPECTS OF THE PHILOSOPHY OF SCIENCE

ABSTRACT. Philosophy of Science, understood as a special philosophical discipline, was born only at the beginning of the twentieth century as part of the effort for overcoming the “foundational crisis” that had affected especially mathematics and physics. Therefore, it was conceived as an investigation about the features and reliability of scientific knowledge and for a few decades was deeply marked by the philosophical approach of logical empiricism. This cognitive point of view persisted also when, after Kuhn’s work, the attention focused on the scientific activity in order to understand scientific change and a sociological model replaced the view that empirical adequacy and logical consistency are the factors that determine the change of scientific theories. Ethical, social and political considerations regarding science were considered inappropriate and potentially dangerous since they violate the alleged “neutrality of science” with respect to values. Nevertheless, the strict intertwining of science and technology in contemporary “technoscience” has produced a wide debate regarding the practical aspect of technoscientific activity that has the intrinsic features of a philosophical debate. Therefore, it is natural and advisable that the entire wealth of the philosophical disciplines (and not just logic, ontology, epistemology and philosophy of language) be called to contribute to the specific complex discourse of the Philosophy of Science. © 2021, The Author(s), under exclusive licence to Springer Nature B.V.

Agazzi, E. (2021). The Multiple Aspects of the Philosophy of Science. *Axiomathes*, 31(6), 677-693. doi: 10.1007/s10516-021-09568-1. Article.

Vania Rocío Aldrete Cortez

SNI Nivel Candidato

HABITUATION ALTERATION IN INFANTS WITH PERIVENTRICULAR ECHOGENICITY AS AN INDICATOR OF NEUROCOGNITIVE IMPAIRMENT

ABSTRACT. Habituation difficulties may suggest neurocognitive impairment. Periventricular echogenicity (PVE) potentially causes subtle damage that poses neuropsychological risk. Habituation was evaluated through heart rate and behavioral states in infants at 36–37 weeks of corrected age between control and PVE groups. PVE infants

showed early alertness and abrupt changes in behavioral states. However, the comparison group could better regulate their states. Heart rate was significantly high and remained unchanged in the PVE group but decreased in the control group. Alterations during the habituation paradigm in PVE infants could be early indicators of neuropsychological risk impairment. Scope of early habituation assessment is discussed. © 2021 Taylor & Francis Group, LLC.

Aldrete-Cortez, V., Tafoya, S. A., Ramírez-García, L. A., & Polblanco A. (2021). Habituation Alteration in Infants with Periventricular Echogenicity as an Indicator of Neurocognitive Impairment. *Developmental Neuropsychology*, 46(1), 82-92. doi: 10.1080/87565641.2020.1871482. Article.

Guillermo Rafael Cantú Quintanilla

Profesor investigador

VALIDATION OF THE PATIENT DIGNITY INVENTORY IN MEXICAN CANCER PATIENTS

ABSTRACT. Introduction: The Patient Dignity Inventory (PDI) is a reliable screening instrument for a variety of problems (physical, existential, and social) that affect the dignity of patients during their end of life. The PDI has been translated into several different languages and has been validated in different settings. As such, it is important to validate the instrument in patients with cancer in Mexico to assess dignity in this population. The aim of this study was to translate and validate the Spanish version of the PDI in Mexican patients with cancer. Methods: This is a cross-sectional study that included patients with cancer, both those enrolled and not enrolled in palliative care, at the Instituto Nacional de Cancerología in Mexico City from September 2018 to August 2019. A translation and back translation were performed to obtain the Mexican version of the PDI (PDI-Mx) instrument. Patients completed the PDI-Mx, the Hospital Anxiety and Depression Scale (HADS), and functional scales (Eastern Cooperative Oncology Group [ECOG] and Karnofsky). Psychometric properties were evaluated by determining internal consistency, exploratory and confirmatory factor analysis (CFA), and concurrent validity with the HADS. Results: We included 290 participants with cancer (145 in palliative care and 145 not enrolled in palliative care). The Cronbach’s alpha of the PDI-Mx was 0.95. There was a significant correlation with the HADS ($r_s = 0.757$, $p < 0.0001$). The factor analysis showed four factors that explain 64.7% of the model. The CFA presented adequate indicators, which show the adjustment of the structure that indicates a balanced and parsimonious model. Conclusions:

The Mexican version of the PDI shows adequate psychometric properties in patients with cancer. We suggest the use of PDI-Mx in clinical care and research. The study was approved by the Institutional Review Board and Ethics Committee with numbers (016/063/CPI) and (CEI/1115/16) respectively. © Copyright 2021, Mary Ann Liebert, Inc., publishers 2021.

Rodríguez-Mayoral, O., Galindo-Vázquez, O., Alende-Pérez, S., Arzate-Mireles, C., Peña-Nieves, A., Cantú-Quintanilla, G., Lerma, A., & Chochinov, H. M. (2021). Validation of the patient dignity inventory in Mexican cancer patients. *Journal of Palliative Medicine*, 24(11), 1626-1633. doi: 10.1089/jpm.2020.0572. Article.

Víctor Hugo Gálvez Zúñiga

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PLANNING DEFICITS IN HUNTINGTON’S DISEASE: A BRAIN STRUCTURAL CORRELATION BY VOXEL-BASED MORPHOMETRY

ABSTRACT. Introduction Early Huntington’s disease (HD) patients begin to show planning deficits even before motor alterations start to manifest. Generally, planning ability is associated with the functioning of anterior brain areas such as the medial prefrontal cortex. However, early HD neuropathology involves significant atrophy in the occipital and parietal cortex, suggesting that more posterior regions could also be involved in these planning deficits. Objective To identify brain regions associated with planning deficits in HD patients at an early clinical stage. Materials and methods Twenty-two HD-subjects genetically confirmed with incipient clinical manifestation and twenty healthy subjects were recruited. All participants underwent MRI T1 image acquisition as well as testing in the Stockings of Cambridge (SOC) task to measure planning ability. First, group comparison of SOC measures were performed. Then, correlation voxel-based morphometry analyses were done between gray matter degeneration and SOC performance in the HD group. Results Accuracy and efficiency planning scores correlated with gray matter density in right lingual gyrus, middle temporal gyrus, anterior cingulate gyrus, and paracingulate gyrus. Conclusions Our results suggest that planning deficits exhibited by early HD-subjects are related to occipital and temporal cortical degeneration in addition to the frontal areas deterioration. © 2021 Calderon-Villalon et al. This is an open access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Calderon-Villalon, J., Ramirez-Garcia, G., Fernandez-Ruiz, J., Sangri-Gil, F., Campos-Romo, A., & Galvez, V. (2021). Planning deficits in Huntington’s disease: A brain structural correlation by voxel-based morphometry. *PLoS ONE*, 16(3). Art. e0249144. doi: 10.1371/journal.pone.0249144. Article.

Desiderio Salomón Hernández Gutiérrez

SNI Nivel I

ANTIPROLIFERATIVE ACTIVITY OF STANDARDIZED PHYTOPREPARATIONS FROM IBERVILLEA SONORAE (S. WATSON) GREENE

ABSTRACT. *Ibervillea sonorae* (Cucurbitaceae) is a medicinal plant utilized in Northwest Mexico against Diabetes and cancer. This natural product is taken orally, its presentation is capsules containing the plant’s dried and powdered caudices. There is no regulation or standardized dosage that allows reproducibility of its pharmacological effects. Cucurbitacins are the main group of compounds found in *I. sonorae* and are known for their antiproliferative activity in cancer cells. Cucurbitacin IIb (CIIb), one of the compounds present in *I. sonorae*, has demonstrated in experimental models with HeLa cervical cancer cells an apoptotic and anti-tumoral activity. The objective of this study is to obtain and standardize two phytopreparations of *I. sonorae* based on their CIIb content, evaluate their antiproliferative activity in cancer cell lines, and compare the results with those obtained with CIIb; expecting to find phytopreparations with anti-cancer potential. APCI-IT-MSn is utilized for the identification of cucurbitacins, FT-ICR-MS/MS for the quantification of CIIb, and the MTT assay for the evaluation of the antiproliferative activity. The CIIb content was 0.67% for Fito-Ison-EtOH and 1.84% for Fito-Ison-EtOAc. In both phytopreparations, six cucurbitacins have been identified, and a seventh one not previously identified. Phytopreparations were more effective against HeLa, with IC50 of 30.0 and 18.6 µg/mL for Fito-Ison-EtOH and Fito-Ison-EtOAc, respectively. This effect is lower than observed on CIIb in HeLa (5.8 µg/mL). There are no significant differences ($p > 0.05$) in the antiproliferative activity between Fito-Ison-EtOAc and CIIb in A549, LS180, and MDA-MB-231 cells. Phytopreparations of *I. sonorae* have potential for the development of anti-cancer products. © 2021.

Vidal-Gutiérrez, M., Torres-Moreno, H., Hernández-Gutiérrez, S., Velázquez, C., Robles-Zepeda, R. E., & Villegas, W. (2021). Antiproliferative activity of standardized phytopreparations from *Ibervillea sonorae* (S. Watson) Greene. *Steroids*, 169. Art. 108824. doi: 10.1016/j.steroids.2021.108824. Article.

INCREASED CD47 AND MHC CLASS I INHIBITORY SIGNALS EXPRESSION IN SENESCENT CD1 PRIMARY MOUSE LUNG FIBROBLASTS

ABSTRACT. Cellular senescence is more than a proliferative arrest in response to various stimuli. Senescent cells (SC) participate in several physiological processes, and their adequate removal is essential to maintain tissue and organism homeostasis. However, SC accumulation in aging and age-related diseases alters the tissue microenvironment leading to deterioration. The immune system clears the SC, but the specific scenarios and mechanisms related to recognizing and eliminating them are unknown. Hence, we aimed to evaluate the existence of three regulatory signals of phagocytic function, CD47, major histocompatibility complex class I (MHC-I), and calreticulin, present in the membrane of SC. Therefore, primary fibroblasts were isolated from CD1 female mice lungs, and stress-induced premature senescence (SIPS) was induced with hydrogen peroxide. Replicative senescence (RS) was used as a second senescent model. Our results revealed a considerable increment of CD47 and MHC-I in RS and SIPS fibroblasts. At the same time, no significant changes were found in calreticulin, suggesting that those signals might be associated with evading immune system recognition and thus averting senescent cells clearance. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

Hernández-Mercado, E., Prieto-Chávez, J. L., Arriaga-Pizano L. A., Hernández-Gutiérrez, S., Mendlovic, F., Königsberg, M., & López-Díazguerrero, N. E. (2021). Increased CD47 and MHC class I inhibitory signals expression in senescent cd1 primary mouse lung fibroblasts. *International Journal of Molecular Sciences*, 22(19). Art. 10215. doi: 10.3390/ijms221910215. Article

DECREASED KIDNEY FUNCTION AND AGRICULTURAL WORK: A CROSS-SECTIONAL STUDY IN MIDDLE-AGED ADULTS FROM TIERRA BLANCA, MEXICO

ABSTRACT. Background: We aimed to determine the prevalence of decreased kidney function in a potential chronic kidney disease (KD) of unknown aetiology hotspot in Mexico, assess its distribution across occupations and examine the associated risk factors. Methods: A cross-sectional study collected sociodemographic, occupational,

medical and biometric data from 616 men and women aged 20-60 years who were residents of three communities within the Tierra Blanca region in Mexico. Kidney function was assessed by standardized serum creatinine and estimated glomerular filtration rate (eGFR) and semi-quantitative albumin-to-creatinine ratio (ACR). To examine the distribution of decreased kidney function within the population, age- and sex-adjusted prevalence of low eGFR (≤ 60 mL/min/1.73 m²) was estimated for all participants and across occupations. Multivariable logistic regression was used to assess the association of occupation with having low eGFR. Results: Of the 579 participants analysed (37 excluded due to missing data), the age- and sex-adjusted prevalence of low eGFR was 3.5%. Agriculture was the occupation associated with the highest adjusted prevalence of low eGFR (8.8%), with 1 in every 11 agricultural workers having low eGFR. Working in agriculture was independently associated with more than a 5-fold risk of having low eGFR [odds ratio 5.2 (95% confidence interval 1.1-24.3), $P = 0.032$], after adjustment for age, sex, diabetes, hypertension, body mass index, ACR and family history of KD. Additionally, a quarter of the population (25%) had either low eGFR or an ACR > 30 mg/g, mostly due to albuminuria. Conclusions: Our work suggests that there is a high prevalence of decreased kidney function in Tierra Blanca, particularly amongst agricultural workers. © 2020 The Author(s) 2020. Published by Oxford University Press on behalf of ERA-EDTA. All rights reserved.

Aguilar-Ramírez, D., Raña-Custodio, A., Villa, A., Rubilar, X., Olvera, N., Escobar, A., Johnson, R. J., Sánchez-Lozada, L., Obrador, G. T., & Madero, M. (2021). Decreased kidney function and agricultural work: a cross-sectional study in middle-aged adults from Tierra Blanca, Mexico. *Nephrology, Dialysis, Transplantation*, 36(6), 1030-1038. doi: 10.1093/ndt/gfaa041. Article.

HYBRID PERIPHERAL NERVE SHEATH TUMOR, WITH MYXOID SCHWANNOMA, NEUROBLASTOMA-LIKE SCHWANNOMA, AND PERINEURIOMA COMPONENTS

[TUMOR HÍBRIDO DE LA VAINA DEL NERVO PERIFÉRICO, CON COMPONENTES DE SCHWANNOMA MIXOIDE, SCHWANNOMA TIPO NEUROBLASTOMA Y PERINEUROMA]

ABSTRACT. A 43-year-old female presented with an oval eccentric solid lesion fixed to the submandibular gland. The tumor was composed of bland spindle cells embedded in a myxoid stroma with

focal areas showing large cellular rosettes. Both areas were positive for S100 protein and glial fibrillary acidic protein. Some of the elongated spindle cells were also positive for epithelial membrane antigen, and glucose transporter 1, indicating perineurial cell differentiation. A diagnosis of hybrid tumor with myxoid schwannoma, neuroblastoma-like schwannoma and perineuroma components was rendered. The lesion was resected completely and has not recurred after eight months of resection. © 2020 Sociedad Mexicana de Oncología.

Macari-Jorge, A. & Ortiz-Hidalgo, C. (2021). Hybrid peripheral nerve sheath tumor, with myxoid schwannoma, neuroblastoma-like schwannoma, and perineuroma components [Tumor híbrido de la vaina del nervio periférico, con componentes de schwannoma mixoide, schwannoma tipo neuroblastoma y perineuroma]. *Gaceta Mexicana de Oncología*, 20, S158-S162. doi: 10.24875/j.gamo.20000112. Article.

IMMUNOHISTOCHEMISTRY IN HISTORICAL PERSPECTIVE: KNOWING THE PAST TO UNDERSTAND THE PRESENT

ABSTRACT. Immunohistochemistry is an extraordinary and extensively used technique whereby antibodies are used to detect antigens in cells within a tissue section. It has numerous applications in medicine, particularly in cancer diagnosis. It was Albert Hewett Coons, Hugh J. Creech, Norman Jones, and Ernst Berliner who conceptualized and first implemented the procedure of immunofluorescence in 1941. They used fluorescein isothiocyanate (FITC)-labelled antibodies to localize pneumococcal antigens in infected tissues. Since then, with improvement and development of protein conjugation, enzyme labels have been introduced, such as peroxidase and alkaline phosphatase. The history of immunohistochemistry (IHC) combines physiology, immunology, biochemistry, and the work of various Nobel Prize laureates. From von Behring who was awarded the first Nobel Prize in 1901 for his work on serum therapy to the 1984 Nobel Prize for the discovery of monoclonal antibodies by Milstein, Kohler, and Jerne, IHC is a story of cooperation and collaboration which led to the development of this magnificent technique that is used daily in anatomical pathology laboratories worldwide. © 2022, Springer Science+Business Media, LLC, part of Springer Nature.

Ortiz Hidalgo, C. (2022). Immunohistochemistry in Historical Perspective: Knowing the Past to Understand the Present. In J. M. Walker (ed.), *Methods in Molecular Biology*, vol. 2422, (pp. 17-31). Springer. doi: 10.1007/978-1-0716-1948-3_2. Book Chapter.

LUCY OF SYRACUSE. PATRON SAINT OF EYE DISORDERS

ABSTRACT. Saint Lucy (the virgin martyr of Syracuse) is recognized today as the patroness of those who suffer from blindness and eye ailments. Lucy was accused of being a Christian, and was executed in Syracuse, in 304 during the Diocletianic Persecution. Lucy had consecrated her virginity to God; however, her mother Eutychia arranged Lucy's marriage to a young man. Lucy refused to marry him and was punished by governor Paschasius who ordered the guards to remove her eyes. This is the reason why Lucy is the patron saint of eye illnesses. When her body was being prepared for burial, it was discovered that her eyes had been miraculously restored. In paintings, Lucy is frequently shown holding her eyes on a golden dish. She also holds the palm branch, a symbol of martyrdom and victory over evil. © 2020 Sociedad Mexicana de Oftalmología. Publicado por Permyan. Este es un artículo open access bajo la licencia CC BY-NC-ND (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Ortiz-Hidalgo, C. (2021). Lucy of syracuse. Patron saint of eye disorders [Lucía de Siracusa: Santa patrona de las enfermedades]. *Revista Mexicana de Oftalmología*, 95(1), 28-34. doi: 10.24875/RMO.M20000152. Article.

NEW CHALLENGES FOR ETHICS: THE SOCIAL IMPACT OF POSTHUMANISM, ROBOTS, AND ARTIFICIAL INTELLIGENCE

ABSTRACT. The ethical approach to science and technology is based on their use and application in extremely diverse fields. Less prominence has been given to the theme of the profound changes in our conception of human nature produced by the most recent developments in artificial intelligence and robotics due to their capacity to simulate an increasing number of human activities traditionally attributed to man as manifestations of the higher spiritual dimension inherent in his nature. Hence, a kind of contrast between nature and artificiality has ensued in which conformity with nature is presented as a criterion of morality and the artificial is legitimized only as an aid to nature. On the contrary, this essay maintains that artificiality is precisely the specific expression of human nature which has, in fact, made a powerful contribution to the progress of man. However, science and technology do not offer criteria to guide

the practical and conceptual use of their own contents simply because they do not contain the conceptual space for the ought-to-be. Therefore, this paper offers a critical analysis of the conceptual models and the most typical products of technoscience as well as a discerning evaluation of the contemporary cultural trend of transhumanism. The position defended here consists of full appreciation of technoscience integrated into a broader framework of specifically human values. © 2021 Lourdes Velázquez G.

Velázquez G L. (2021). New Challenges for Ethics: The Social Impact of Posthumanism, Robots, and Artificial Intelligence. *Journal of Healthcare Engineering*, 2021. Art. 5593467. doi: 10.1155/2021/5593467. Article.

Lourdes Velázquez González

SNI Nivel II

THE INCOSMICON RESEARCH CENTER AND ITS ACTIVITIES IN THE FIELD OF SETI, BIG HISTORY AND INTERCULTURALITY

ABSTRACT. As announced at the IAC 2019 held in Washington, at the beginning of 2020 the University of Insubria (Italy), in collaboration with the UCSS of Lima (Peru), has created a new research center called InCosmiCon (Intelligence in the Cosmic Context), based at the Department of Human Sciences, Innovation and Territory (DISUIT). Its goal is to investigate the nature of intelligence in an interdisciplinary way and with a realistic approach, in the context of the history of humankind, of our planet and the whole universe, avoiding the specular errors of reductionism and dualism. InCosmiCon has already been joined by various illustrious scientists in the field of space sciences, as the former IAU Secretary General Piero Benvenuti, now Honorary President of InCosmiCon, and also by some members of the IAA SETI Committee, as Paolo Musso, Director of InCosmiCon, and the present Chairman of the IAA SETI Committee Claudio Maccone, who has been nominated Coordinator of the InCosmiCon SETI Section, whose aim is to support the implementation of SETI programs everywhere it is possible, especially in Italy and Latin America, and to participate in the interdisciplinary work about extraterrestrial intelligence promoted by the IAA SETI Committee. Other Sections of InCosmiCon are devoted to Big History and Intercultural Communication, especially focusing on the extraordinary experience of the UCSS Amazonian seat, the UCSS-Nopoki of Atalaya, which could be also a model for a positive interaction with a hypothetical extraterrestrial civilization. In the present paper some of the InCosmiCon members are going to present its structure, its first results,

and its projects for the next future, while a separate paper will be specifically devoted to a Peruvian project about Astrobiology and Optical SETI. Copyright © 2020 by the International Astronautical Federation (IAF). All rights reserved.

Musso P., Antonietti, N., Asla, M., Atachahua, W., Azcona, G., Benvenuti, P., Francesco, B., Biavaschi, P., Capatinta, M., Ceroni, M., Sánchez, L. C., Crippa, R., de Paulis, D., Dutil, Y., Facchetti, G., Facchin, L., Gómez, Á., Gustafson, L., Jordan, A., Laffitte, L., Lagos, D., López, D., Maccone, C., Maspero, G., Melis, A., Montebugnoli, S., Monticelli, R. C. F., Navarro, J., Oliva, J., Pagan, F., Mariotto, F. P., Pereyra, C., Rossi, L., Savio, G., Spiriti, A., Vaidyanathan, B., Valdivia-Silva, J., Vargas, T., González, L.V., Cervantes, V. D. V., Viana, C., Vianelli, A., Vicentini, A., Vincas, P.V., Zapata, R., & Zumaeta, E. (2020). The InCosmiCon research center and its activities in the field of SETI, big history and interculturality. 71st International Astronautical Congress, virtual online. IAC, 2020. Conference Paper.

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¹ Colaboración en un artículo publicado en Escuela de Gobierno y Economía (p. 34).





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² Colaboración en cinco artículos publicados en Facultad de Ingeniería (pp. 108, 110, 111).

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FINANCIAL PRUDENTIAL BEHAVIOR AND ECONOMIC GROWTH

ABSTRACT. The 2008 global financial crisis showed not only that there is a link between real economy and financial markets, but also that financial stability is necessary for investment, innovation and of course economic growth. Regarding the link between real and financial sectors, several studies long before the 2008 financial crisis revealed positive impacts from financial sector on real economy, basically because a solid financial system promote physic and human capital accumulation, see Banerjee and Newman (1993) Galor and Zeira (1993), Aghion and Bolton (1997), Piketty (1997), Levine (1997), Levine and Zervos (1998), Rajan and Zingales (1998). When considering well-developed financial markets as economic growth promoters the researches of Levine (2005), Aghion et al. (2005) and Acemoglu et al. (2006) proved that financial develop indeed accelerates economic growth. © 2019 Universidad Nacional Autónoma de México, Facultad de Contaduría y Administración. This is an open access article under the CC BY-NC-SA (<https://creativecommons.org/licenses/by-nc-sa/4.0/>).

Rivas-Aceves, S. & Dávila-Aragón, G. (2021). Financial prudential behavior and economic growth. *Contaduría y Administración*, 66(3). doi: 10.22201/fca.24488410e.2021.2674. Article.

Rafael Garduño Rivera

Investigador Titular D, SNI Nivel II

LAW AND ECONOMICS CHALLENGES OF NATURAL GAS-THE HARD CASE OF MEXICO

ABSTRACT. This article addresses the risks and uncertainties for Mexico derived from the excessive dependency on US natural gas. It will take as a reference Btu price fluctuation and the covenants contained on the based contract for sale and purchase of natural gas, particularly in the context of the behaviour displayed by market participants (including governments) during the recent winter storm energy crisis in Texas which consequently forced shortages in Mexico due to a lack of 'available' natural gas to produce power (electricity). The research question includes: Should Mexico exploit its vast natural gas resources although it might not be a sustainable or a cost-effective (economically-socially and environmentally) decision? (The curse of the TEX-MEX-NG). Or instead, would it be better to prepare (within the

limits of its financial situation) to address the US natural gas price fluctuations, like price hedging? Or a combination of both? © 2021 Oxford University Press. All rights reserved.

Cervantes, M. M. & Rivera, R. G. (2021). Law and economics challenges of natural gas-the hard case of Mexico. *Journal of World Energy Law and Business*, 14(3), 205-214. doi: 10.1093/jwelb/jwab017. Article.

Rafael Garduño Rivera

Investigador Titular D, SNI Nivel II

MARKET COMPETITION AND FIRM PRODUCTIVITY AND INNOVATION: RESPONSES IN MEXICAN MANUFACTURING INDUSTRIES

ABSTRACT. This paper investigates the causal relationship between competition and firm innovation and the impact of competition on firm productivity in the Mexican manufacturing sector. We use the analytical framework proposed by Aghion et al. (2005) and evaluate their central hypothesis. We use firm-level data from the Mexican manufacturing survey over the period 2009-2017. Our results show a negative linear relationship between competition and the intensity of firm innovation investment. These results are primarily due to the substantial technological disparity that exists across firms within sectors, where most firms compete very far from the leaders. © 2021 The Authors. Regional Science Policy & Practice © 2021 Regional Science Association International.

Atayde, R., Garduño, R., Robles, E., & Zúñiga, P. (2021). Market competition and firm productivity and innovation: Responses in Mexican manufacturing industries. *Regional Science Policy and Practice*, 13(4), 1185-1214. doi: 10.1111/rsp3.12417. Article.

Rafael Hernández Cázares

Profesor investigador

STRATEGIZING FOR THE BOTTOM OF THE PYRAMID: AN ACTION RESEARCH INTO A MEXICAN AGRIBUSINESS

ABSTRACT. Purpose: While recent research has established that businesses can benefit from engaging with people at the bottom of the pyramid (BOP), the authors know little about the practices that managers can use to effectively strategize this ethically sound and financially attractive proposition and turn it into new business. Design/methodology/approach: To address this gap, the authors reported on an action research study in which the authors collaborated with a major Mexican agribusiness, ANSA, to expand its market through value

co-creation with the country's poorest farmers. To shape the strategizing, the authors combined dynamic capability theory and options theory, and the authors used the asset hexagon framework to understand the BOP population's needs. Findings: The authors offer a detailed account of how ANSA's management team collaborated downstream with distributors and farmers and upstream with suppliers to grow a new micro-franchise business that increases the well-being of the poorest farmers and creates additional business opportunities. The research describes how firms can strategize and implement new business ventures for co-creating value with the BOP population. The results are a process model and related propositions for strategizing value co-creation with BOP. Originality/value: The authors offer new empirical insights, a grounded process model and model-related propositions on strategizing BOP options. As such, the study contributes to the BOP literature by joining critical ethics with actionable knowledge of how such efforts may unfold and by demonstrating how theory may be enacted and developed in the process. © 2019, Emerald Publishing Limited.

Hernandez-Cazares, R., Lawson-Lartego, L., Mathiassen, L., & Quinonez-Romandia, S. (2019). Strategizing for the bottom of the pyramid: an action research into a Mexican agribusiness. *Journal of Business and Industrial Marketing*, 35(10), 1475-1489. doi: 10.1108/JBIM-01-2019-0042. Article.

Andrée Marie López Fernández

SNI Nivel I

ANALYSIS OF MEDICAL TOURISM AND THE EFFECT OF USING DIGITAL TOOLS TO PROFILE TRAVELERS IN MEXICO

ABSTRACT. The increase of internet services and the availability of new cutting-edge technology, as well as the use of mobile apps and devices, set a major challenge for medical tourism service providers. E-commerce sites and social networks are an important source for consumers' awareness and knowledge regarding the medical tourism business model in México which has grown at accelerated rates in recent years; therefore their use should be enhanced by formalizing this activity, and creating integrated commercial strategies. Word-of-mouth and the Internet are consumers' preferred sources of information for medical tourism, where trust is elemental for the perception of quality online information. The use of social networks as a means of reference and information based on other users' experiences and recommendations, as well as the use of mobile applications, have contributed to making electronic commerce increasingly profitable for companies that incorporate them in their business

model. This research analyzes the preferences of consumption of medical tourism services in Mexico to determine the effect of formalizing the offer of services with the help of a digital platform on the consumers' experiences. The study seeks to determine, through the integration of different cluster methodologies, which are the profiles of medical tourism travelers to better predict their consumption habits and channel the various options available through the use of digital tools and social networks to promote the most attractive alternatives for consumers' benefit, which translates into higher sales impacting the entire value chain of this sector. © 2021, ICST Institute for Computer Sciences, Social Informatics and Telecommunications Engineering.

Arrija-Castrejón, E. & López-Fernández, A. M. (2021). Analysis of Medical Tourism and the Effect of Using Digital Tools to Profile Travelers in Mexico. 5th EAI International Conference on Computer Science and Engineering in Health Services, COMPSE 2021, virtual online. *LNICST*, 393, 143-161. doi: 10.1007/978-3-030-87495-7_10. Conference Paper.

Andrée Marie López Fernández

SNI Nivel I

LEADERSHIP AND CSR DRIVING FRUGAL AND REVERSE INNOVATIONS: A CONCEPTUAL FRAMEWORK FOR SME-MNE PARTNERSHIPS

ABSTRACT. A firm's leadership environment is a significant determinant of its overall direction, the way it approaches its business dynamics. Small firms and those operating in emerging markets tend to be disregarded when discussing innovativeness, social responsibility and business growth. However, it is suggested that a partnership may, in fact, not only achieve the latter but also significantly impact social growth and development. This paper contributes to the literature on innovation, leadership and corporate social responsibility as it puts forth two models, one with defined propositions, and the other with suggested implications of potential innovation transformation. They propose a shift in the link between CSR, innovativeness, and SME-MNE partnerships. It is suggested that innovations may undergo an evolution from frugal to corporate socially responsible innovations. The dynamics of a socially responsible, innovative, partnership directly reflect on business and social growth and development; therefore, also potentiating partnerships in developing and developed markets. Copyright © 2019 Inderscience Enterprises Ltd.

López-Fernández, A. M. & Rajagopal (2018). Leadership and CSR driving frugal and reverse innovations: A conceptual framework for SME-MNE partnerships. *International Journal of Business Innovation and Research*, 17(3), 417-436. doi: 10.1504/IJBIR.2018.095545. Article.

Carlos Vladimiro González Zelaya
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OPTIMISING FAIRNESS THROUGH PARAMETRISED DATA SAMPLING

ABSTRACT. Improving machine learning models' fairness is an active research topic, with most approaches focusing on specific definitions of fairness. In contrast, we propose ParDS, a parametrised data sampling method by which we can optimise the fairness ratios observed on a test set, in a way that is agnostic to both the specific fairness definitions, and the chosen classification model. Given a training set with one binary protected attribute and a binary label, our approach involves correcting the positive rate for both the favoured and unfavoured groups through resampling of the training set. We present experimental evidence showing that the amount of resampling can be optimised to achieve target fairness ratios for a specific training set and fairness definition, while preserving most of the model's accuracy. We discuss conditions for the method to be viable, and then extend the method to include multiple protected attributes. In our experiments we use three different sampling strategies, and we report results for three commonly used definitions of fairness, and three public benchmark datasets: Adult Income, COMPAS and German Credit. © 2021 Copyright held by the owner/author(s).

González-Zelaya, V., Salas, J., Prangle, D., & Missier, P. (2021). Optimising fairness through parametrised data sampling. *Advances in Database Technology - 24th International Conference on Extending Database Technology, Nicosia, Cyprus. EDBT, 2021*, 445-450. doi: 10.5441/002/edbt.2021.49. Conference Paper.

Enrique Martín Murillo Othón
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REIMAGINING ATTRACTION AND RETENTION OF HOSPITALITY MANAGEMENT TALENT- A MULTILEVEL IDENTITY PERSPECTIVE

ABSTRACT. Through the lens of hospitality, an industry with chronic retention issues, this article seeks to stimulate reflection on labor-intensive industries and how we can reimagine their responses to an evolving labor market environment when seeking to attract and retain management talent. Drawing on identity economics, whereby employees' identity utility is an important incentive in employment decision-making, the necessity for a multilevel perspective of identity formation is advanced. Positing that employees' work identity is informed by individual (micro), organizational (meso), and professional (macro) level factors, this perspective illuminates the

important role that macro level stakeholders play in employee identity formation, particularly in the hospitality industry. Further, it emphasizes the interconnectedness of levels in shaping an employee's identity and career decisions. Through a series of research questions, a line of inquiry is articulated for the purpose of addressing the challenges of attracting and retaining management talent from a holistic identity formation perspective. © 2021 Elsevier Inc.

King, C., Madera, J. M., Lee, L., Murillo, E., Baum, T., & Solnet, D. (2021). Reimagining attraction and retention of hospitality management talent- A multilevel identity perspective. *Journal of Business Research*, 136, 251-262. doi: 10.1016/j.jbusres.2021.07.044. Article.

Francisco Ortiz Arango
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IMPACT OF MEXICO'S ENERGY REFORM ON CONSUMER WELFARE

ABSTRACT. We study the impact of Mexico's energy reform on the welfare of electricity, liquefied petroleum gas, and gasoline consumers between 2010 and 2018. We utilize micro-level data to estimate income and price elasticities. Comparative statics are used to determine subsidy and price influences on consumer surplus. A counterfactual is used to simulate the industry's behavior under non-reform parameters. Data cover ten income deciles and sociodemographic characteristics in the National Survey of Household Income and Expenditure. We conclude that consumers of energy goods in the post-reform experimental group (2014-2018) experienced a welfare gain compared to consumers in the control group (2010-2014) at the expense of alternative social costs related to energy subsidies. © 2021 Elsevier Ltd.

Ramírez, J. C., Ortiz-Arango, F., & Rosellón, J. (2021). Impact of Mexico's energy reform on consumer welfare. *Utilities Policy*, 70. Art. 101191 doi: 10.1016/j.jup.2021.101191. Article.

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PROFITABILITY USING SECOND-GENERATION BIOETHANOL IN GASOLINE PRODUCED IN MEXICO

ABSTRACT. Gasoline produced in Mexico by the productive company of the state Petróleos Mexicanos (PEMEX) mainly uses oil-derived ethers as oxygenators to reach the Mexican Regulatory 'Frame-work's octane number. An alternative to complying with these regulations could be to use

bioethanol as an oxygenate. However, as a gasoline component, this could affect Mexico's food markets since sugar cane, and grains are the primary inputs for local production. The main objective of this study is to evaluate whether the use of bioethanol, produced from corn stubble, as an additive in gasoline produced by Petróleos Mexicanos (PEMEX) is profitable in Mexico, from the perspective of the evaluation of the supply chain and the finances. The purpose of this work is to contribute to the definition of the advantages and limitations for the existence of a second-generation bioethanol market produced from Lignocellulosic corn biomass and integrated into the gasoline market of national production in Mexico. The work starts with theoretical research to define the use of corn stubble as raw material, set up on its availability and feasibility determined based on a geographic information system (GIS), through the use of the agricultural production forecast approach, as well as the integration of costs and financial analysis. The results show that corn stubble bioethanol production is technically viable, but the production cost is not competitive yet. Although its price is not yet competitive compared to the imported price, using a fiscal incentive scheme and considering the decrease in energy dependence, it would be feasible to produce it in Mexico. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

Bautista-Herrera, A., Ortiz-Arango, F., & Álvarez-García, J. (2021). Profitability using second-generation bioethanol in gasoline produced in Mexico. *Energies*, 14(8). Art. 2294. doi: 10.3390/en14082294. Article.

Francisco Ortiz Arango
SNI Nivel II

Griselda Dávila Aragón
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THE FINANCE OF MEXICAN HOUSEHOLDS: ANALYSIS WITH BAYESIAN NETWORKS

[LAS FINANZAS DE LOS HOGARES MEXICANOS: ANÁLISIS CON REDES BAYESIANAS]

ABSTRACT. In today's economy, the well-being of households is considered to be linked mainly to the development of financial markets. The field of household finance analyzes how households use financial instruments to satisfy their needs and achieve objectives. This analysis represents a significant challenge due to scarce statistical information and the interrelation among the variables involved. We follow two aspects: Traditional and behavioral finance. This paper pioneers the use of Bayesian networks in the field. A model measuring the probability of preva-

lence of financial stability of households in Mexico is used; a baseline result is obtained and then, while generating different scenarios, we discover that credit management and household composition are the most determining variables. These results underscore the importance of promoting different financial education initiatives at different educational levels, modalities, and subsystems. © 2021 Universidad Nacional Autónoma de México.

Aragón, G. D., Arango, F. O., & Llanos, A. I. C. (2021). The finance of Mexican households: Analysis with Bayesian networks [Las finanzas de los hogares mexicanos: Análisis con redes Bayesianas]. *Investigación Económica*, 80(317), 109-134. doi: 10.22201/E.01851667P.2021.317.77127. Article.

Francisco Ortiz Arango
SNI Nivel II

THE MARKOVIAN PATTERN OF SOCIAL DEPRIVATION FOR MEXICANS WITH DIABETES

ABSTRACT. This paper aims to determine the Markovian pattern of the factors influencing social deprivation in Mexicans with Type 2 diabetes mellitus (DM2). To this end, we develop a methodology to meet the theoretical and practical considerations involved in applying a Hidden Markov Model that uses non-panel data. After estimating the latent states and ergodic vectors for diabetic and non-diabetic populations, we find that the long-term state-dependent probabilities for people with DM2 show a darker perspective of impoverishment than the rest of the Mexican population. In the absence of extreme events that modify the present probability structure, the Markovian pattern confirms that people with DM2 will most likely become the poorest of Mexico's poor. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

Ramírez, J. C., Ortiz-Arango, F., & Mata, L. (2021). The markovian pattern of social deprivation for mexicans with diabetes. *Mathematics*, 9(7). Art. 780. doi: 10.3390/math9070780. Article.

Adrián Ramírez Nafarrate
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Hugo Briseño Ramírez
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A MULTIVARIATE ANALYSIS OF HYBRID AND ELECTRIC VEHICLES SALES IN MEXICO

ABSTRACT. This paper presents a multivariate analysis considering economic and ecological factors that are associated with the acquisition of low

emission vehicles in Mexico. We analyzed the data available in the Mexican context from its 32 states and use econometric analyses with linear regression models to determine the significant factors associated with the sales of hybrid and electric vehicles. We found that the sales of these vehicles are positively correlated with the GDP per capita, the cost of consumed electricity, the price of gasoline and an indicator variable defined for sustainable practices. This indicator variable is calculated using data on the certificates issued by the government environmental office, energy intensity, adequate disposal of waste and waste separation. Based on these results, we infer that adherence to sustainable practices has a positive correlation with the acquisition of low emission vehicles in Mexico. However, for the buyers, the affordability of these vehicles is more important than their energy efficiency. In addition, we found that the most industrialized states are adopting hybrid and electric vehicles at higher rates than states whose economy depends on commerce and tourism. © 2020 Elsevier Ltd.

Briseño, H., Ramírez-Nafarrate, A., & Araz, O. M. (2020). A multivariate analysis of hybrid and electric vehicles sales in Mexico. *Socio-Economic Planning Sciences*, 76. Art. 100957. doi: 10.1016/j.seps.2020.100957. Article.

Adrián Ramírez Nafarrate
Investigador Titular D, SNI Nivel II

A SIMULATION-OPTIMIZATION STUDY OF THE INVENTORY OF A BIKE-SHARING SYSTEM: THE CASE OF MEXICO CITY ECOBICI'S SYSTEM

ABSTRACT. Bike-sharing systems (BSS) are a healthy and environmentally friendly alternative for public transportation in many large urban areas around the world. In 2010, Mexico City started its BSS, named Ecobici, with 84 stations and reached more than 840,000 trips that year. Ecobici rapidly became a preferred option for many users. By 2019, the number of stations in Ecobici had grown almost 6 times since the first year. In addition, the number of registered trips on 2019 was more than 8.4 million and the number of trips in a weekday were more than 30,000. In order to incentivize the adoption of bike as transportation mode, Ecobici and other BSS need to handle the bike inventory at their stations throughout the day. There are many challenges for optimizing bike inventory in BSS given the complex interdependencies, the non-homogeneous demand flows, and the large-scale scenarios. In this paper, we propose and study a simulation-optimization framework to minimize the number of shortage events (failed bike withdrawals and returns) by setting an adequate bike inventory at each station

throughout the day. We propose an efficient modeling approach to simulate large-scale BSS and a simulation-optimization heuristic to optimize bike inventory. The experiments show that these algorithms obtain results with similar quality than other search methods, but in a significant shorter amount of time. © 2021 World Conference on Transport Research Society.

Gómez Márquez, H. R., López Bracho, R., & Ramírez-Nafarrate, A. (2021). A simulation-optimization study of the inventory of a bike-sharing system: The case of Mexico City Ecobici's system. *Case Studies on Transport Policy*, 9(3), 1059-1072. doi: 10.1016/j.cstp.2021.01.014. Article.

Adrián Ramírez Nafarrate
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DECISION ASSESSMENT ALGORITHMS FOR LOCATION AND CAPACITY OPTIMIZATION UNDER RESOURCE SHORTAGES

ABSTRACT. Emergency response preparedness requires strategic and operational planning. As natural disasters, disease outbreaks, and bioterrorism continue to threaten public health and the global economic system, policy makers and businesses develop plans for improving their readiness. These emergencies present challenging problems that require evaluation of several trade-offs due to insufficient resources and capacity with limited response time pressure. Finding an optimal strategy to these problems can be computationally difficult, since they are formulated as large-scale service network design models with location-allocation decisions. The facility location problems in disaster management literature are typically known as (Formula presented.) -hard problems. Therefore, heuristic algorithms can help find practically feasible solutions, but decision makers may have to sacrifice one of their objectives while trying to satisfy multiple of them. This paper presents a flexible algorithm to evaluate trade-offs in resource scarce situations with a given response time. We formulate the location-allocation problem with capacity and time constraints, and the objective of minimizing the service time for individuals in an affected area. Due to the complexity to solve the problem for large-scale scenarios, the presented algorithm relaxes capacity and time constraints, simultaneously, and presents flexibility to assess trade-offs. A modified NSGA-II algorithm is used with a penalty function formulated to leverage resources. We analyze how values of the penalty parameters interact with a number of open sites in defining an efficient resource allocation strategy. Therefore, decision makers can expand their choices to design an emergency response network with their

preferences taken into consideration. © 2019 Decision Sciences Institute.

Ramírez-Nafarrate, A, Araz, O. M. & Fowler, J. W. (2021). Decision Assessment Algorithms for Location and Capacity Optimization under Resource Shortages. *Decision Sciences*, 52(1), 142-181. doi: 10.1111/deci.12418. Article.

Héctor Xavier Ramírez Pérez
Profesor investigador

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INNOVATION AND INTERNATIONALIZATION: GRUPO LORSA: A FAMILY FIRM THAT FOUND INNOVATION FROM WITHIN

ABSTRACT. In 2015, Mexico and Brazil had been the countries with the highest growth rates, reaching a gross domestic product (GDP) of USD\$1.21 and US\$2.3 trillion respectively, versus other countries such as Argentina, Chile, and Peru. During the first forty years, the main business in Lorsa consisted of selling equipment for laundries and dry-cleaners. The first attempt of the company started in 1953 in Guadalajara by its founder Luis Ousset, an entrepreneur who had worked as an employee and independent advisor in the dry-cleaning sector in Guadalajara and Mexico City for eleven years before starting his own business. He got married in 1951, and had seven children. The children were involved in the company since a young age. Even though all four sons were working in the company, it seemed that the first successor was going to be Luis Jr. He was in charge of key accounts for Lorsa and was the most important sales agent. © 2019 Taylor & Francis.

Ramírez-Pérez, H. X., Jimenez-Castillo, L., & Rivas-Aceves, S. (2018). Innovation and internationalization: Grupo lorsa: A family firm that found innovation from within. In C. G. Müller, I. C. Botero, A. D. Cruz, & R. Subramanian, *Family Firms in Latin America* (pp. 174-184). Routledge. doi: 10.4324/9781315098630-23. Book Chapter.

Román Rodríguez Aguilar
SNI Nivel II

AN ASSET INDEX PROPOSAL FOR HOUSEHOLDS IN MEXICO APPLYING THE MIXED PRINCIPAL COMPONENTS ANALYSIS METHODOLOGY

ABSTRACT. The development of assets indices has grown as an alternative to measure wealth from

different generations in the evaluation of social mobility. A proposal of the development of an asset index is presented using the GSVD-based mixed principal components analysis (PCAMix package in R). The contribution rests in the combination of both numerical and categorical data and the integration of the simultaneous effect of these variables in the index. It was used in profiling the Mexican households according to the information from the 2018 National Household Income and Expenditure and the determination of the Gini coefficient to evaluate the inequality of distribution at the state level. Results show a high level of disparity in the distribution of assets with only 0.01% of the households possessing 40% or more of the assets included in the index, being the southern region where greatest challenges for ascending social mobility. © 2021, ICST Institute for Computer Sciences, Social Informatics and Telecommunications Engineering.

DelaTorre-Díaz, L. & Rodríguez-Aguilar R. (2021). An Asset Index Proposal for Households in Mexico Applying the Mixed Principal Components Analysis Methodology. 5th EAI International Conference on Computer Science and Engineering in Health Services, COM-PSE 2021, virtual online. *LNICST*, 393, 88-106. doi: 10.1007/978-3-030-87495-7_7. Conference Paper.

Román Rodríguez Aguilar
SNI Nivel II

APPLICATION OF SPECTRAL CLUSTERING FOR THE DETECTION OF HIGH PRIORITY AREAS OF ATTENTION FOR COVID-19 IN MEXICO

ABSTRACT. The recent COVID-19 pandemic has represented a great challenge for health systems around the world. That is why it is necessary to propose strategies for prioritizing care and containing the pandemic. This work proposes the use of spectral clustering to characterize high-priority areas of care based on key information on the performance of the pandemic as well as health system variables. The result shows the generation of high priority areas not only due to the deaths observed but also due to the clinical, demographic and health system variables. © 2021, ICST Institute for Computer Sciences, Social Informatics and Telecommunications Engineering.

Roman, R. A. (2021). Application of Spectral Clustering for the Detection of High Priority Areas of Attention for COVID-19 in Mexico. 4th EAI International Conference on Computer Science and Health Engineering in Health Services, COMPSE 2020, virtual online. *LNICST*, 359, 130-142. doi: 10.1007/978-3-030-69839-3_9. Conference Paper.

Román Rodríguez Aguilar

SNI Nivel II

José Antonio Marmolejo Saucedo

SNI Nivel II

ESTIMATION OF THE STOCHASTIC VOLATILITY OF OIL PRICES OF THE MEXICAN BASKET: AN APPLICATION OF BOOSTING MONTE CARLO MARKOV CHAIN ESTIMATION

ABSTRACT. The volatility of the returns on financial assets is not a constant number over time as many valuation models, mainly derivatives, developed during the 80's, assume. The complexity of non-heteroscedasticity and the difference in results when estimated with different methodologies such as historical, implicit or stochastic calculation, make this subject too extensive a field to be covered in this work. However, stochastic volatility has been widely accepted in recent years. Monte Carlo Markov Chain (MCMC) method is explained and used to estimate the distribution of oil prices of Mexican basket as a stochastic variable. MCMC in the univariate case, supposes that we can estimate the distribution of a latent (hidden) variable through the behavior of another variable observed posteriori with the help of Bayesian inference; this method allows an efficient inference independent of the underlying process through an algorithm. The results show a correct adjustment of stochastic volatility to the behavior of the oil prices. © 2021, The Author(s), under exclusive license to Springer Nature Switzerland AG.

Rodríguez-Aguilar, R. & Marmolejo-Saucedo, J. A. (2021). Estimation of the Stochastic Volatility of Oil Prices of the Mexican Basket: An Application of Boosting Monte Carlo Markov Chain Estimation. *Lecture Notes on Data Engineering and Communications Technologies*, vol. 76, (pp. 742-754). Springer. doi: 10.1007/978-3-030-79357-9_68. Book Chapter.

Román Rodríguez Aguilar

SNI Nivel II

GUIDE FOR SUSTAINABLE PROJECT ANALYSIS TO IMPROVE ENERGY EFFICIENCY OF MEXICAN SME

ABSTRACT. Faced with the need of overall cleaner production processes, the Government of Mexico, in coalition with international cooperation agencies, has made efforts to spark to a cleaner transition by the conferment of financing under preferential conditions for small and medium-sized enterprises (SMEs), which are the backbone of the

Mexican economy. This will help the implementation of sustainable projects that promote the reduction of energy consumption and Greenhouse Gas (GHG) emissions. However, these efforts have not yielded the expected results since the viability of the loans is determined by the Financial Institutions (FIs) based solely on profitability analysis of the SMEs. If this analysis is complemented with consideration of environmental and social aspects, a greater number of projects would be subject to financing. Real Options method allows the calculation of future cash flows incorporating the uncertainty from the volatility associated with the projects, allowing future adjustments to be made to them based on their performance. In addition, under the economic cost-effectiveness analysis, costs incurred in the implemented projects are compared against the results, assigning a monetary value to them to determine their overall impact. Derived from the limitations in the valuation of sustainable projects in SMEs, this article aims to establish a guide for comprehensive evaluation, using a cost-effectiveness approach and addressing the uncertainty of the project through Real Options. Considering the diversity of the SME during this study, the target companies and the type of projects that have the best opportunities for successful application of the proposed guide were segmented. © 2021, ICST Institute for Computer Sciences, Social Informatics and Telecommunications Engineering.

Reyes Ortega, L. M. A. & Rodríguez Aguilar, R. (2021). Guide for Sustainable Project Analysis to Improve Energy Efficiency of Mexican SME. 4th EAI International Conference on Computer Science and Health Engineering in Health Services, COMPSE 2020, virtual online. *LNICST*, 359, 12-30. doi: 10.1007/978-3-030-69839-3_2. Conference Paper.

Román Rodríguez Aguilar

SNI Nivel II

SENTIMENT ANALYSIS MODEL ON TWITTER ABOUT VIDEO STREAMING PLATFORMS IN MEXICO

ABSTRACT. This work addresses the analysis of the content of the comments on Twitter in the period from December 2020 to February 2021 on the video streaming platforms in Mexico: Netflix, Disney+ and Prime Video. The analysis involves the extraction of comments on Twitter, cleaning the text and the development of a supervised support model for Text Mining for the sentiment classification of tweets in the categories: Positive, Negative or Neutral (spam); as well as the use of resampling techniques to measure the vari-

ability of the model's performance and improve the precision of its parameters. The result allows the measurement of user satisfaction levels and the detection of the most dissatisfied and liked aspects of the platforms. Finally, a business intelligence dashboard was developed in Power BI for the interactive visualization of the results under different information filters. The results show that there is a large percentage of Neutral tweets (spam) that refer mainly to advertising about new releases. Netflix's satisfaction level is the highest compared to the rest of the platforms due to the liking for its original series, variety, and dynamism of launches; on the contrary, the most unpleasant aspect is removing content from your catalog. For its part, Disney+ has satisfaction lower due to the limited variety of its catalog and the expense involved. In the case of Prime Video, lower levels of satisfaction are observed for removing content from its catalog and for paying more than one platform per month. The application of this methodology could benefit in measurement of satisfaction levels, understanding, decision-making and monitoring of new strategies implemented by the platforms. © 2021, ICST Institute for Computer Sciences, Social Informatics and Telecommunications Engineering.

Andrade-Gonzalez, R. & Rodríguez-Aguilar, R. (2021). Sentiment Analysis Model on Twitter About Video Streaming Platforms in Mexico. 5th EAI International Conference on Computer Science and Engineering in Health Services, COMPSE 2021. *LNICST*, 393, 73-87. doi: 10.1007/978-3-030-87495-7_6. Conference Paper.

Omar Guillermo Rojas Altamirano

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Hugo Briseño Ramírez

Investigador Titular A, SNI Nivel Candidato

FACTORS ASSOCIATED WITH ELECTRICITY LOSSES IN COLOMBIA

ABSTRACT. The purpose of this research is to explore the factors associated with transmission and distribution electricity losses in Colombia, measured through the proxy variable non-technical losses. A literature review is carried out to find out the variables that have been significant in past studies. Once the issue is contextualized in the Colombian case, a statistical and econometric analysis is developed with the available variables. Transmission and distribution electricity losses were found to be positively significantly associated with crime, unemployment, and income; while these have a negative association with urbanization and population density. Results are

of interest to practitioners, academics and policy makers. © 2021, Econjournals. All rights reserved.

Briseño, H., Rubiano, J., García, R., & Rojas, O. (2021). Factors associated with electricity losses in Colombia. *International Journal of Energy Economics and Policy*, 11(6), 465-470. doi: 10.32479/ijeep.11590. Article.

Omar Guillermo Rojas Altamirano

Investigador Titular D, SNI Nivel I

Guillermo Sosa Gómez

Profesor investigador

INFORMATION THEORY BASED EVALUATION OF THE RC4 STREAM CIPHER OUTPUTS

ABSTRACT. This paper presents a criterion, based on information theory, to measure the amount of average information provided by the sequences of outputs of the RC4 on the internal state. The test statistic used is the sum of the maximum plausible estimates of the entropies $H(jt|zt)$, corresponding to the probability distributions $P(jt|zt)$ of the sequences of random variables $(jt)_{t \in T}$ and $(zt)_{t \in T}$, independent, but not identically distributed, where zt are the known values of the outputs, while jt is one of the unknown elements of the internal state of the RC4. It is experimentally demonstrated that the test statistic allows for determining the most vulnerable RC4 outputs, and it is proposed to be used as a vulnerability metric for each RC4 output sequence concerning the iterative probabilistic attack. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

Madarro-Capó, E. J., Legón-Pérez, C. M., Rojas, O., & Sosa-Gómez, G. (2021). Information theory based evaluation of the rc4 stream cipher outputs. *Entropy*, 23(7). Art. 896. doi: 10.3390/e23070896. Article.

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SELECTING AN EFFECTIVE ENTROPY ESTIMATOR FOR SHORT SEQUENCES OF BITS AND BYTES WITH MAXIMUM ENTROPY

ABSTRACT. Entropy makes it possible to measure the uncertainty about an information source from the distribution of its output symbols. It is known that the maximum Shannon's entropy of a discrete source of information is reached when its symbols follow a Uniform distribution. In cryp-

tography, these sources have great applications since they allow for the highest security standards to be reached. In this work, the most effective estimator is selected to estimate entropy in short samples of bytes and bits with maximum entropy. For this, 18 estimators were compared. Results concerning the comparisons published in the literature between these estimators are discussed. The most suitable estimator is determined experimentally, based on its bias, the mean square error short samples of bytes and bits. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

Rodríguez, L. C., Madarro-Capó, E. J., Legón-Pérez, C. M., Rojas, O., & Sosa-Gómez, G. (2021). Selecting an effective entropy estimator for short sequences of bits and bytes with maximum entropy. *Entropy*, 23(5). Art. 561 doi: 10.3390/e23050561. Article.

Omar Guillermo Rojas Altamirano

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TEST FOR DETECTION OF WEAK GRAPHIC PASSWORDS IN PASSPOINT BASED ON THE MEAN DISTANCE BETWEEN POINTS

ABSTRACT. This work demonstrates the ineffectiveness of the Ripley's K function tests, the distance to the nearest neighbor, and the empty space function in the Graphical Authentication scenario with Passpoint for the detection of non-random graphical passwords. The results obtained show that none of these tests effectively detect non-random graphical passwords; the reason for their failure is attributed to the small sample of the spatial pattern in question, where only the five points of the graphical password are analyzed. Consequently, a test based on mean distances is proposed, whose experiments show that it detects with good efficiency non-random graphical passwords in Passpoint. The test was designed to be included in the Graphical Authentication systems with Passpoint to warn the user about a possibly weak password during the registration phase, and in this way, the security of the system is increased. © 2021 by the authors.

Herrera-Macías, J. A., Legón-Pérez, C. M., Suárez-Plasencia, L., Piñero-Díaz, L. R., Rojas, O., & Sosa-Gómez, G. (2021). Test for detection of weak graphic passwords in passpoint based on the mean distance between points. *Symmetry*, 13(5), 777. doi: 10.3390/sym13050777. Article.

Jacqueline Yvette Sánchez García

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Carlos Eduardo López Hernández

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SYSTEMIC COMPLEMENTARITY, AN INTEGRATIVE MODEL OF COOPERATION AMONG SMALL AND MEDIUM-SIZED TOURISM ENTERPRISES IN MEXICO

ABSTRACT. This article explores cooperation among small and medium-sized tourism companies as a way to adapt better to their context because the lack of organisation and control affect their equilibrium and life cycle. The systemic complementarity was explored to maximise responsive and adaptive capabilities considering heterogeneity in these companies. The viable system approach was adopted to treat conflictual relations in these companies; in that sense, the viable system model was applied to develop coherent relationships, foster collaborative interactions and seek equilibrium. The functions and communication processes in the model distribute necessary information to enrich management and operations considering the environment. Also, the culture and interaction among actors foster ownership and engagement to achieve viability. Finally, through organisational cybernetics, it is attempted to contribute to strengthen these organisations and help them to identify their opportunities as a whole. Copyright © 2020 Inderscience Enterprises Ltd.

Sánchez-García, J. Y., Núñez-Ríos, J. E., & López-Hernández, C. (2020). Systemic complementarity, an integrative model of cooperation among small and medium-sized tourism enterprises in Mexico. *International Journal of Business Innovation and Research*, 23(3), 354-369. doi: 10.1504/IJBIR.2020.110968. Article.

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Juan Enrique Núñez Ríos

Investigador Titular B, SNI Nivel Candidato

SYSTEMIC COMPLEMENTARITY MODEL FOR MEXICAN TOURIST MSMEs, CONTRASTED WITH ANALYTICAL HIERARCHY PROCESS

ABSTRACT. The micro, small and medium tourist enterprises (MSMEs) have an organisational structure that restricts their adaptive capabilities to a highly competitive environment. The purpose of

this article is to present, from a systems science approach, a construct specific for MSMEs based on the complementarity concept. The soft systems methodology (SSM) was used to diagnose and structure the problem, detect elements of impact as well as to suggest plausible actions for change. The analytic hierarchy process (AHP) was used to validate the conceptual model. In this sense, consistency values above 90% were obtained for the construct's components. Based on this, the construct corresponds to the environment in which the studied organisations operate. The relations in the proposed construct seek to propose what heterogeneous characteristics integrate for fostering responsive and adaptive capabilities to the context. Copyright © 2021 Inderscience Enterprises Ltd.

Sánchez-García, J. Y., Núñez-Ríos, J. E., & Coria-Páez, A. L. (2021). Systemic complementarity model for Mexican tourist MSMEs, contrasted with analytical hierarchy process. *International Journal of Business and Systems Research*, 15(5), 629-649. doi: 10.1504/IJBRSR.2021.117316. Article.

Germán Roberto Scalzo Molina

Investigador Titular D, SNI Nivel I

AUTONOMOUS SELF AND INTER-PROCESSUAL SELF: TWO WAYS OF EXPLAINING HOW PEOPLE "SEE" AND LIVE RELATIONSHIPS AND THE RESULTING DIALOGUE BETWEEN SCIENCE AND FAITH

ABSTRACT. The relationship between science and faith is not a given, nor is it objectively defined, but rather depends on personal ways of approaching this relationship. Accordingly, it can be lived as a conflict, i.e. as agency striving to master independent and separate domains or as a process of dialogue or an integral relationship. In this chapter, we suggest that adopting one stance or the other depends on factors that go beyond the rational assessment that a person makes of science or faith. To explain the perspective that people adopt, cross-disciplinary theoretical insights relevant to human beings and their development are decisive. Based on previous research consolidating several theoretical proposals across a diverse disciplinary orientation (mainly philosophy, psychology and neuroscience), we suggest that there are two contrasting paradigms for conceiving of the self and human development, namely, the autonomous self (AS) and the inter-processual self (IPS) (Akrivou K, Orón JV: Challenges of capitalism for virtue and the common good: Inter-disciplinary perspectives. Edward Elgar, Cheltenham, 2016). We purport here that, depending on which of these two corresponding backgrounds characterises the person,

people will 'see' and live the relationship—dialogue between science and faith—differently. © 2019, Springer Nature Switzerland AG.

Orón, J. V., Akrivou, K., & Scalzo, G. (2019). Autonomous Self and Inter-Processual Self: Two Ways of Explaining How People "See" and Live Relationships and the Resulting Dialogue Between Science and Faith. In D. L. Zeidler (ed.). *Contemporary Trends and Issues in Science Education*, vol. 48, (pp. 91-101). Springer. doi: 10.1007/978-3-030-17234-3_8. Book Chapter.

Germán Roberto Scalzo Molina

Investigador Titular D, SNI Nivel I

AUTONOMY AND SUBORDINATION: VIRTUOUS WORK IN LIGHT OF ARISTOTELIAN PRACTICAL KNOWLEDGE IN ORGANIZATIONAL THEORY

ABSTRACT. This paper aims to integrate the concept of autonomous and subordinated work into Aristotelian organizational theory by enhancing the epistemological framework of neo-Aristotelianism and by adding a Thomistic interpretation of organizational practical knowledge. We sustain that, in order to advance our understanding of the firm in terms of excellence and the common good, the concept of practical knowledge applied to organizational theory requires reflection on the nature of work in modern organizations. For this, we will explain (i) how an organization that aims for excellence is most appropriately defined as a community of autonomous work, (ii) how practical knowledge in organizations must be defined considering work as deliberative production and, finally, (iii) how productivity in organizations is best described when work is envisioned in terms of autonomy and subordination. © Business & Professional Ethics Journal.

Pinto-Garay, J., Scalzo, G., & Ferrero, I. (2021). Autonomy and subordination: Virtuous work in light of aristotelian practical knowledge in organizational theory. *Business and Professional Ethics Journal*, 40(1), 47-80. doi: 10.5840/bpej20201227104. Article.

Germán Roberto Scalzo Molina

Investigador Titular D, SNI Nivel I

CSR AND VIRTUE ETHICS: THE COMMON GOOD OF FIRMS, MARKETS, AND CIVIL SOCIETY

ABSTRACT. This chapter probes the social responsibility of firms using a virtue ethics approach and the concept of the common good. In particular, it highlights the contrasting assumptions of mainstream approaches and the common good of the firm approach to explaining how the latter

-rooted in Aristotelian virtue ethics- provides an original conception of social responsibility. A common good approach to social justice understands social relationships essentially as duties to which one voluntarily adheres; when said justice and commitment to the common good flourishes, community ensues. Finally, a virtue ethics approach to corporate social responsibility establishes three forms of duty and social responsibility to stakeholders, including those who make up the firm, those who maintain a market-based relationship with it, and those who are related to the firm as part of society's civic sphere.

Scalzo, G., Pinto-Garay, J., & Akrivou, K. (2021). CSR and virtue ethics: The common good of firms, markets, and civil society. In T. Maak, N. M. Pless, M. Orlitzky, & S. Sandhu (eds.), *The Routledge Companion to Corporate Social Responsibility* (pp. 78-87). Routledge. Book Chapter.

Germán Roberto Scalzo Molina

Investigador Titular D, SNI Nivel I

FROM MARY'S MOTHERHOOD TO THE IMMACULATE CONCEPTION: AN ICONOGRAPHIC ANALYSIS OF MARIAN ART IN SPAIN DURING THE TENTH TO NINETEENTH CENTURIES

ABSTRACT. This article analyzes Marian art in Spain from the tenth to nineteenth centuries in order to show how popular piety represented Mary's motherhood. Through art, including architecture, painting, sculpture, and oral preaching, a popular image of Mary emerged and, in turn, became key for understanding the history of the family in western Catholic countries. Studying the evolution of Marian iconography during this thousand-year period reveals a kind of grandeur, and then a certain crisis, surrounding Mary's motherhood. This crisis specifically involves the meaning of the body as an effective sign of the personal gift-of-self. We argue that this process ran parallel to growing problems in theological culture related to reconciling the natural and supernatural realms, and we further sustain that it contains a true cultural revolution, a shift that is at the origin of many later transformations. This interpretation helps better understand the dilemmas surrounding the history of the family in the West, and specifically of motherhood, from the point of view of the Christian tradition. © 2021 by the author. Licensee MDPI, Basel, Switzerland.

Moreno-Almárcegui, A. & Scalzo, G. (2021). From mary's motherhood to the immaculate conception: An iconographic analysis of marian art in spain during the tenth to nineteenth centuries. *Religions*, 12(12). Art. 1061. doi: 10.3390/rel12121061. Article.

Germán Roberto Scalzo Molina

Investigador Titular D, SNI Nivel I

PERSON-CENTERED LEADERSHIP: THE PRACTICAL IDEA AS A DYNAMIC PRINCIPLE FOR ETHICAL LEADERSHIP

ABSTRACT. In search of ethical conceptual frameworks that are applicable to the practical reality of companies, ethical leadership has recently gained ground in Business Ethics scholarship as a broad umbrella under which to fit both normative and descriptive approaches to management. This article delves into Carlos Llano's seminal studies in the field, and his rediscovery of the "practical idea" as a dynamic principle for integrating the practice of management and ethical leadership in light of a realistic personalism. Llano was one of the first authors to study the firm from a humanistic, people-centered perspective as a "community or people," and his view of practical wisdom is an effort to integrate this intellectual virtue with human will by offering a personalist open dynamism that is at the center of all relationships at work, allowing those involved to grow therein. Hence, his notion of the practical idea is his most original contribution to the promotion of managerial action as a catalyst for person-centered leadership. © Copyright © 2021 Murcio and Scalzo.

Murcio, R. & Scalzo, G. (2021). Person-Centered Leadership: The Practical Idea as a Dynamic Principle for Ethical Leadership. *Frontiers in Psychology*, 12. Art. 708849. doi: 10.3389/fpsyg.2021.708849. Article.

Germán Roberto Scalzo Molina

Investigador Titular D, SNI Nivel I

PRICING FOR A COMMON GOOD: BEYOND ETHICAL MINIMALISM IN COMMERCIAL PRACTICES

ABSTRACT. Pricing policies and fair-trade practices are critical for sustaining commercial relationships between firms and customers. Nevertheless, in current business practices, fairness has been mistakenly reduced to a minimalistic ethic wherein justice only demands legal and explicit norms to which commercial parties voluntarily agree. Aimed at giving a different explanation of commercial agreements, this paper will introduce a Virtue Ethics (VE) explanation of the relationship between pricing and the common good by taking up classical concepts related to justice in commerce. In particular, we will explore three principles associated with the notion of fairness in commerce as defined in Neo-Aristo-

telian ethics towards a relationship between a common good and justice in pricing, i.e., proportionality, benevolence and well-being. To exemplify how these criteria of justice apply to decision-making in commercial practices, we will discuss several cases of fair and unfair commercial relationships. © 2021, The Author(s), under exclusive licence to Springer Nature Switzerland AG part of Springer Nature.

Pinto-Garay, J., Ferrero, I., & Scalzo, G. (2021). Pricing for a Common Good: beyond Ethical Minimalism in Commercial Practices. *Philosophy of Management*, 20(3), 271-291. doi: 10.1007/s40926-020-00162-w. Article.

Germán Roberto Scalzo Molina

Investigador Titular D, SNI Nivel I

María de los Ángeles Padilla Lavín

Profesora investigadora

REBUILDING THE TEMPLE OF GRACES: GIFT-GIVING AS THE FOUNDATION OF CARE

ABSTRACT. The concept of "care" has recently emerged to expand the idea of rationality in economics, introducing insights that have traditionally been restricted to the so-called third sector (non-profit), and, as a result, questioning mainstream economics. This article is based on the thesis that the development and functionality of the market and the state are a result of something previous, i.e., the presence of the gift in social relations. The idea of the gift is related with charis, which is at the root of care and is in addition closely related to the religious concepts of grace and charity. In order to show that this notion was present in the Western classical tradition- from Aristotle to Scholastic thought- this article traces the foundation and evolution of money through the lens of social interaction in terms of friendship and fraternity. Finally, it suggests that a social order based exclusively on contractual exchange relations is a consequence of an interpretation of the gift as a pure and generous gesture without the moral obligation of reciprocity. In opposition to that thesis, critics of modern economics, including feminist and Catholic thinkers, come together to defend the superiority of gift over contract, that is to say, of distributive over commutative justice. © 2018 OEconomia. All rights reserved.

Scalzo, G., Almárcegui, A. M., & De los Ángeles Padilla, M. (2018). Rebuilding the temple of graces: Gift-giving as the foundation of care. *OEconomia*, 8(2), 139-155. doi: 10.4000/OECONOMIA.2858. Article.

Germán Roberto Scalzo Molina

Investigador Titular D, SNI Nivel I

VIRTUOUS WORK AND ORGANIZATIONAL CULTURE: HOW ARISTOTELIAN PRACTICAL WISDOM CAN HUMANIZE BUSINESS

ABSTRACT. This chapter aims to overcome the rationalistic and mechanistic paradigm of organizational theory redefining the nature of organizations as a community of work. We sustain that Aristotelian practical wisdom deepens our understanding of organizations by incorporating different features of personal work in organizational contexts, such as meaning, interpretation, ambiguity, conflict, context-dependence, productivity and reflexivity. In this chapter, we will explain (i) how the organization aimed to excellence is better defined as a community of work, and (ii) how practical wisdom in an organization must be defined in light of work as a deliberative and participative production. Thus, the goal of the chapter is twofold: first, it seeks to introduce a concept of work into the Aristotelian organizational theory; second, it aims to show the potential of Aristotelian practical wisdom for deepening our understanding of organizations by integrating an Aristotelian definition of the community of work and common good into organizational theory. © Designs and Patents Act 1988.

Pinto, J., Ferrero, I., & Scalzo, G. (2021). Virtuous work and organizational culture: How aristotelian practical wisdom can humanize business. M. T. Lepeley, O. Morales, P. Essens, N. J. Beutell, & N. Majluf (eds.), *Human Centered Organizational Culture: Global Dimensions* (pp. 118-126). Routledge. doi: 10.4324/9781003092025-9-11. Book Chapter.

Germán Roberto Scalzo Molina

Investigador Titular D, SNI Nivel I

WORK, GIFT, CULTURE AND ECONOMICS: TOWARDS A NEW APPROACH TO THE ECONOMIC PROBLEM

[TRABAJO, DON, CULTURA Y ECONOMÍA: HACIA UN NUEVO ENFOQUE DEL PROBLEMA ECONÓMICO]

ABSTRACT. The recent recovery of the notion of gift has highlighted the importance of human life's cultural dimension, contributing to the configuration of an economical approach based on a more robust and realistic anthropology that revolves around human sociability, sustained in the family, rather than the individual. The transformation of nature that takes place would not be possible without man's ability to discover the possibilities that are hidden within nature itself, and that man makes clear through the contribution of his work with which he activates the

most valuable elements of his act of being, namely his freedom, his ability to know and love. From an anthropological approach to economics, this work contributes to the reflection on the foundations and meaning of the economic activity. © 2020 Universidad Pontificia de Salamanca, Servicio de Publicaciones. All rights reserved.

Martínez-Echevarría y Ortega M. A. & Molina G. S. (2020). Work, gift, culture and economics: Towards a new approach to the economic problem [Trabajo, don, cultura y economía: Hacia un nuevo enfoque del problema económico]. *Cuadernos Salmantinos de Filosofía*, 47, 381-401. doi: 10.36576/SUMMA.132195. Review.

Guillermo Sosa Gómez

Profesor investigador

Omar Guillermo Rojas Altamirano

Investigador Titular D, SNI Nivel I

A NEW FAMILY OF BOOLEAN FUNCTIONS WITH GOOD CRYPTOGRAPHIC PROPERTIES

ABSTRACT. In 2005, Philippe Guillot presented a new construction of Boolean functions using linear codes as an extension of the Maiorana-McFarland's (MM) construction of bent functions. In this paper, we study a new family of Boolean functions with cryptographically strong properties, such as non-linearity, propagation criterion, resiliency, and balance. The construction of cryptographically strong Boolean functions is a daunting task, and there is currently a wide range of algebraic techniques and heuristics for constructing such functions; however, these methods can be complex, computationally difficult to implement, and not always produce a sufficient variety of functions. We present in this paper a construction of Boolean functions using algebraic codes following Guillot's work. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

Sosa-Gómez, G., Paez-Osuna, O., Rojas, O., & Madarro-Capó, E. J. (2021). A new family of boolean functions with good cryptographic properties. *Axioms*, 10(2). Art. 42. doi: 10.3390/axioms10020042. Article.

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Investigador Titular D, SNI Nivel I

ANALYSIS OF THE NUMBER OF SIDES OF VORONOI POLYGONS IN PASSPOINT

ABSTRACT. The probabilistic distribution of the characteristics of Voronoi polygons has been extensively

studied due to its many areas of application. In various works that differ in the number of polygons generated and in the size of their regions, it is concluded that the expected value of the characteristic number of sides of Voronoi polygons is equal to 6. In this work, this characteristic in the polygons generated by the graphical passwords of the graphical authentication system PassPoint is studied. Its distribution is estimated and it is shown that the expected value of the number of sides of the Voronoi polygons in this scenario differs from previous works. The effectiveness of this feature is evaluated to detect weak graphical passwords made up of grouped dots. They are to be detected by estimating the entropy of the number of sides and by the expected value of the number of sides. It is concluded that the distribution of the number of sides in this scenario does not the 3-parameter gamma distribution reported in previous work or any of 61 distributions that were tested, and that the entropy and the expected value of the number of sides are not efficient for the detection of weak graphical passwords of PassPoint formed by 5 grouped points. © 2021, ICST Institute for Computer Sciences, Social Informatics and Telecommunications Engineering.

Suárez-Plasencia, L., Herrera-Macías, J. A., & Legón-Pérez, C. M., Socorro-LLanes R., Rojas O., Sosa-Gómez G. (2021). Analysis of the Number of Sides of Voronoi Polygons in PassPoint. 4th EAI International Conference on Computer Science and Health Engineering in Health Services, COMPSE 2020, virtual online. *LNICST*, 359, 184-200. doi: 10.1007/978-3-030-69839-3_13. Conference Paper.

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EFFECTIVENESS OF SOME TESTS OF SPATIAL RANDOMNESS IN THE DETECTION OF WEAK GRAPHICAL PASSWORDS IN PASSPOINT

ABSTRACT. This paper explores the usability of the Ripley's K function and the nearest neighbor distance, in the detection of clustered graphical passwords in the graphical authentication stage. For it, both tests were applied to two bases of data of 10,000 clustered graphical passwords each, the first with graphical passwords clustered in an area lesser than the fourth part of the original image, the second clustered in an area lesser than eighth part of the image. The results show that none of these tests is effective in the detection of clustered graphical passwords, the reason of such failure is due to the short size of the spatial pattern in question, only the 5 points of the graphical password analyzed. © 2021,

ICST Institute for Computer Sciences, Social Informatics and Telecommunications Engineering.

Herrera-Macías, J. A., Suárez-Plasencia, L., Legón-Pérez, C. M., Piñero-Díaz, L. R., Rojas, O., & Sosa-Gómez, G. (2021). Effectiveness of Some Tests of Spatial Randomness in the Detection of Weak Graphical Passwords in Passpoint. 4th EAI International Conference on Computer Science and Health Engineering in Health Services, COMPSE 2020. *LNICST*, 359, 173-183. doi: 10.1007/978-3-030-69839-3_12. Conference Paper.

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Elías Olivares Benítez

Investigador Titular D, SNI Nivel I

MATHEURISTICS FOR THE DESIGN OF A MULTI-STEP, MULTI-PRODUCT SUPPLY CHAIN WITH MULTIMODAL TRANSPORT

ABSTRACT. Supply-chain network design is a complex task because there are many decisions involved, and presently, global networks involve many actors and variables, for example, in the automotive, pharmaceutical, and electronics industries. This research addresses a supply-chain network design problem with four levels: suppliers, factories, warehouses, and customers. The problem considered decides on the number, locations, and capacities of factories and warehouses and the transportation between levels in the supply chain. The problem is modeled as a mixed-integer linear program. The main contribution of this work is the proposal of two matheuristic algorithms to solve the problem. Matheuristics are algorithms that combine exact methods and heuristics, attracting interest in the literature because of their fast execution and high-quality solutions. The matheuristics proposed to select the warehouses and their capacities following heuristic rules. Once the warehouses and their capacities are fixed, the algorithms solve reduced models using commercial optimization software. Medium and large instances were generated based on a procedure described in the literature. A comparison is made between the algorithms and the results obtained, solving the model with a time limit. The algorithms proposed are successful in obtaining better results for the largest instances in shorter execution times. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

Ruvalcaba-Sandoval, D. A., Olivares-Benitez, E., Rojas, O., & Sosa-Gómez, G. (2021). Matheuristics for the design of a multi-step, multi-product supply chain with multimodal transport. *Applied Sciences* (Switzerland), 11(21). Art. 10251. doi: 10.3390/app11210251. Article.

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Investigador Titular D, SNI Nivel I

MEASURING AVALANCHE PROPERTIES ON RC4 STREAM CIPHER VARIANTS

ABSTRACT. In the last three decades, the RC4 has been the most cited stream cipher, due to a large amount of research carried out on its operation. In this sense, dissimilar works have been presented on its performance, security, and usability. One of the distinguishing features that stand out the most is the sheer number of RC4 variants proposed. Recently, a weakness has been reported regarding the existence of statistical dependence between the inputs and outputs of the RC4, based on the use of the strict avalanche criterion and the bit independence criterion. This work analyzes the influence of this weakness in some of its variants concerning RC4. The five best-known variants of RC4 were compared experimentally and classified into two groups according to the presence or absence of such a weakness. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

Madarro-Capó, E. J., Legón-Pérez, C. M., Rojas, O., & Sosa-Gómez, G. (2021). Measuring avalanche properties on RC4 stream cipher variants. *Applied Sciences* (Switzerland), 11(20). Art. 9646. doi: 10.3390/app11209646. Article.

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Omar Guillermo Rojas Altamirano

Investigador Titular D, SNI Nivel I

SEARCH-SPACE REDUCTION FOR S-BOXES RESILIENT TO POWER ATTACKS

ABSTRACT. The search of bijective $n \times n$ S-boxes resilient to power attacks in the space of dimension $(2n)!$ is a controversial topic in the cryptology community nowadays. This paper proposes partitioning the space of $(2n)!$ S-boxes into equivalence classes using the hypothetical power leakage according to the Hamming weights model, which ensures a homogeneous theoretical resistance within the class against power attacks. We developed a fast algorithm to generate these S-boxes by class. It was mathematically demonstrated that the theoretical metric confusion coefficient variance takes constant values within each class. A new search strategy—jumping over the class space—is justified to find S-boxes with high confusion coefficient variance in the space partitioned by Hamming weight classes. In addition, a decision criterion is proposed to move quickly between or within classes. The number of classes and the number of

S-boxes within each class are calculated, showing that, as n increases, the class space dimension is an ever-smaller fraction of the space of S-boxes, which significantly reduces the space of search of S-boxes resilient to power attacks, when the search is performed from class to class. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

Legón-Pérez, C. M., Sánchez-Muñoz, R., Miyares-Moreno, D., Bardaji-López, Y., Martínez-Díaz, I., Rojas, O., & Sosa-Gómez, G. (2021). Search-space reduction for s-boxes resilient to power attacks. *Applied Sciences* (Switzerland), 11(11). Art. 4815. doi: 10.3390/app11114815. Article.

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Investigador Titular D, SNI Nivel I

STUDY OF PARAMETERS IN THE GENETIC ALGORITHM FOR THE ATTACK ON BLOCK CIPHERS

ABSTRACT. In recent years, the use of Genetic Algorithms (GAs) in symmetric cryptography, in particular in the cryptanalysis of block ciphers, has increased. In this work, the study of certain parameters that intervene in GAs was carried out, such as the time it takes to execute a certain number of iterations, so that a number of generations to be carried out in an available time can be estimated. Accordingly, the size of the set of individuals that constitute admissible solutions for GAs can be chosen. On the other hand, several fitness functions were introduced, and which ones led to better results was analyzed. The experiments were performed with the block ciphers AES(t), for $t \in \{3, 4, 7\}$. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

Tito-Corrioso, O., Borges-Trenard, M. A., Borges-Quintana, M., Rojas, O., & Sosa-Gómez, G. (2021). Study of parameters in the genetic algorithm for the attack on block ciphers. *Symmetry*, 13(5). Art. 806. doi: 10.3390/sym13050806. Article.

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Investigador Titular D, SNI Nivel I

VARIABLE MESH OPTIMIZATION FOR CONTINUOUS OPTIMIZATION AND MULTIMODAL PROBLEMS

ABSTRACT. Optimization problems with continuous variables are very often in real-life scenarios.

This is why several studies have focused on the use of metaheuristics to solve these problems, known as continuous optimization problems. This chapter focuses on the robust population-based metaheuristic Variable Mesh Optimization (VMO). We review the fundamental aspects of VMO for continuous optimization. Moreover, we analyze the variants of VMO that have been proposed to solve multimodal problems, i.e. those with multiple optima at several search subspaces. The chapter uses a homogeneous algorithmic framework to describe VMO and its variants with niching strategies for multimodal problems. © 2021, The Author(s), under exclusive license to Springer Nature Switzerland AG.

Antón-Vargas, J. A., Quintero-Domínguez, L. A., Sosa-Gómez, G., & Rojas O. (2021). Variable Mesh Optimization for Continuous Optimization and Multimodal Problems. In J. Kacprzyk (ed.), *Studies in Computational Intelligence*, vol. 967, (pp. 301-317). Springer. doi: 10.1007/978-3-030-70542-8_13. Book Chapter.

Antonia Terán Bustamante

Investigadora Titular A, SNI Nivel Candidato

Antonieta Teodora Martínez Velasco

Profesora investigadora

INTERNAL BRANDING IN A SERVICE COMPANY IN MEXICO

[BRANDING INTERNO EN UNA EMPRESA DE SERVICIOS EN MÉXICO]

ABSTRACT. The objective of this research is to analyze the internal branding processes of a knowledge services company in Mexico. This allows there to strengthen competitive advantages through their human capital. The foregoing elucidating whether training and motivation towards the brand positively influence its performance. The methodological strategy is quantitative through statistical tools and machine learning. Evidence shows that employees' alignment with brand values shows a positive and significant impact on their motivation for the brand and its performance. The most significant factors within the commitment dimension are the training and leadership of the bosses. © 2020, Universidad del Zulia. All rights reserved.

Terán-Bustamante, A. & Martínez-Velasco, A. (2020). Internal branding in a service company in Mexico [Branding interno en una empresa de servicios en México]. *Revista Venezolana de Gerencia*, 25(4), 492-513. Article.

Antonia Terán Bustamante

Investigadora Titular A, SNI Nivel Candidato

Griselda Dávila Aragón

Investigadora Titular B, SNI Nivel I

Antonieta Teodora Martínez Velasco

Profesora investigadora

KNOWLEDGE MANAGEMENT FOR OPEN INNOVATION: BAYESIAN NETWORKS THROUGH MACHINE LEARNING

ABSTRACT. Knowledge management within organizations allows to support a global business strategy and represents a systemic and organized attempt to use knowledge within an organization to improve its performance. The objective of this research is to study and analyze knowledge management through Bayesian networks with machine learning techniques, for which a model is made to identify and quantify the various factors that affect the correct management of knowledge in an organization, allowing you to generate value. As a case study, a technology-based services company in Mexico City is analyzed. The evidence found shows the optimal and non-optimal management of knowledge management, and its various factors, through the causality of the variables, allowing us to more adequately capture the interrelationship to manage it. The results show that the most relevant factors for having adequate knowledge management are information management, relational capital, intellectual capital, quality and risk management, and technology assimilation. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

Terán-Bustamante, A., Martínez-Velasco, A., & Dávila-Aragón, G. (2021). Knowledge management for open innovation: Bayesian networks through machine learning. *Journal of Open Innovation: Technology, Market, and Complexity*, 7(1), 1-18. Art. 40. doi: 10.3390/joitmc7010040. Article.

Antonia Terán Bustamante

Investigadora Titular A, SNI Nivel Candidato

Andrée Marie López Fernández

SNI Nivel I

Antonieta Teodora Martínez Velasco

Profesora investigadora

UNIVERSITY-INDUSTRY COLLABORATION: A SUSTAINABLE TECHNOLOGY TRANSFER MODEL

ABSTRACT. Faced with the pandemic caused by COVID-19, universities worldwide are giving a

powerful response to support their communities. One way to provide support is via the collaboration between universities and industries, allowing the co-creation of knowledge that leads to innovation. Historically, universities, as knowledge-intensive organizations (KIOs), have produced knowledge through research. At present, its important contribution to countries' economy is widely recognized through the development of new knowledge and technical know-how. Universities are a source of innovation for firms, which ultimately translates into social welfare improvements. The objective of this research is to analyze the university-firm linkage. The methodological strategy is carried out using Bayesian networks through a model where the main elements of university-industry linking, which impact competitiveness and innovation, are identified and quantified. The technology transfer model shows that the most crucial processes are Technology Strategy, Value Proposal, Knowledge Management, Control and Monitoring, Innovation Management, Needs Detection, Knowledge Creation, New Products and Services, and Absorption Capacity. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

Terán-Bustamante, A., Martínez-Velasco, A., & López-Fernández, A. M. (2021). University-industry collaboration: A sustainable technology transfer model. *Administrative Sciences*, 11(4). Art. 142. doi: 10.3390/admsci11040142. Article.

Edgar Demetrio Tovar García

Investigador Titular D, SNI Nivel II

MEXICO'S EXTERNAL RESTRICTION AND TRADE COMPOSITION: A BILATERAL APPROACH

[LA RESTRICCIÓN EXTERNA DE MÉXICO Y LA COMPOSICIÓN DEL COMERCIO EN UN ENFOQUE BILATERAL]

ABSTRACT. Recent studies have questioned the explanatory power of Thirlwall's Law in the case of Mexico and other developing countries, due to its omission of foreign trade specialization and use of time series for empirical evaluation. In response to these criticisms, this article estimates income elasticities of export and import demand using dynamic panel models in a bilateral framework between Mexico and 39 trading partners, including the composition of exports and imports as key regressors. Once controlled for the composition of international trade, the results from the estimates using the weak version of Thirlwall's Law accurately predict the economic growth

observed in Mexico between 1990 and 2016. © 2021 Universidad Nacional Autónoma de México. All rights reserved.

Carrasco, C. A. & Tovar-García, E. D. (2021). Mexico's external restriction and trade composition: A bilateral approach [La restricción externa de México y la composición del comercio en un enfoque bilateral]. *Problemas del Desarrollo*, 52(204), 113-140. doi: 10.22201/IIEC.20078951E.2021.204.69599. Article.

Edgar Demetrio Tovar García

Investigador Titular D, SNI Nivel II

PARTICIPATION IN SPORTS, PHYSICAL EXERCISE, AND WAGE INCOME: EVIDENCE FROM RUSSIAN LONGITUDINAL DATA

[TEILNAHME AN SPORT, KÖRPERLICHER AKTIVITÄT UND ARBEITSEINKOMMEN: EVIDENZ AUS LONGITUDINALSTUDIEN IN RUSSLAND]

ABSTRACT. In this article, associations between different types of sports/physical exercise and wage income are analyzed. Using data from the Russian Longitudinal Monitoring Survey, several Mincer earnings functions were estimated in dynamic and static models, controlling for gender, city size, ethnicity, civil status, number of children, migration background, type of occupation, health status, weight, and height. The main findings suggest that those who participate in sports/physical exercise obtain higher wages, about 6–10%, in comparison with sedentary individuals. In addition, the intensity of physical exercise is positively linked to wages. Moreover, the empirical strategy pinpointed the specific activities with robust effects: using exercise equipment, swimming, dancing, and aerobics. However, the evidence does not show significant associations in the case of clerical support workers. The findings of this research are a reminder to support public policies on physical activities and sport facilities at the local level and for ordinary people. In addition to the well-known effects of sports/physical exercise on health status, the evidence suggests wage increases, that is, labor productivity. © 2021, Springer-Verlag GmbH Deutschland, ein Teil von Springer Nature.

Tovar-García, E. D. (2021). Participation in sports, physical exercise, and wage income: Evidence from Russian longitudinal data [Teilnahme an Sport, körperlicher Aktivität und Arbeitseinkommen: Evidenz aus Longitudinalstudien in Russland]. *German Journal of Exercise and Sport Research*, 51(3), 333-343. doi: 10.1007/s12662-021-00727-5. Article.

Edgar Demetrio Tovar García

Investigador Titular D, SNI Nivel II

THE ASSOCIATIONS OF DIFFERENT TYPES OF SPORTS AND EXERCISE WITH HEALTH STATUS AND DISEASES: EVIDENCE FROM RUSSIAN LONGITUDINAL DATA

ABSTRACT. Purpose: The positive effect of physical activity on health status is well established in the literature, yet little is known about the links between specific types of sports/exercise and different diseases. Accordingly, this article investigates these associations in the long term using a representative sample from Russia. Methods: The data are taken from the Russia Longitudinal Monitoring Survey, over the years 2000–2017. The sample consists of adults between 18 and 60 years old. Because the variables on health and diseases are ordinal or binary, the main empirical strategy consists of ordered and binary logistic regressions. Results: Combat sports and the use of exercise equipment are positively associated with the probabilities of being classified in the higher levels of health status; other activities did not show robust results. Moreover, there are negative associations between aerobic/athletic sports and diseases of the joints, heart and lungs. By contrast, pleasure walking presented positive associations with diseases of the upper respiratory tract and heart, with allergies and varicose veins, with eye, spinal, neurological, urogenital, and other chronic diseases. The results are slightly different in male and female subsamples. Conclusion: Different types of sports/exercise show different associations with health status and different diseases. This research recommends the use of exercise equipment, combat, athletic, and aerobic sports. Yet, it is not possible to claim causality, so further research should employ experimental designs using these findings as a guide. © 2021, The Author(s), under exclusive licence to Springer-Verlag Italia S.r.l. part of Springer Nature.

Tovar-García, E. D. (2021). The associations of different types of sports and exercise with health status and diseases: evidence from Russian longitudinal data. *Sport Sciences for Health*, 17(3), 687-697. doi: 10.1007/s11332-021-00734-x. Article.

Edgar Demetrio Tovar García

Investigador Titular D, SNI Nivel II

TRADE AND GROWTH IN DEVELOPING COUNTRIES: THE ROLE OF EXPORT COMPOSITION, IMPORT COMPOSITION AND EXPORT DIVERSIFICATION

ABSTRACT. We investigate the trade-economic growth nexus in developing countries consid-

ering the structure of the external sector. The economic literature has examined the effects on growth of export composition, export diversification and import composition, individually. We add to this discussion by jointly evaluating the role of these three factors in the trade-economic growth nexus. The assessment of the structure of the external sector allows identifying the features that improve the trade-economic growth nexus with relevant economic policy implications for developing countries. Using a sample of 19 developing countries and dynamic panel data models, we found that export composition and export diversification are insignificant. By contrast, the domestic content of exports, the share of high-tech imports and capital goods imports are positively associated with economic growth. Consequently, developing countries growth benefits from high-tech and capital goods imports, and potentially, from the development of an industrial policy able to boost the domestic production of inputs for the exporting sector. © 2020, Springer Science+Business Media, LLC, part of Springer Nature.

Carrasco, C. A. & Tovar-García, E. D. (2020). Trade and growth in developing countries: the role of export composition, import composition and export diversification. *Economic Change and Restructuring*, 54(4), 919-941. doi: 10.1007/s10644-020-09291-8. Article.

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Germán Roberto Scalzo Molina

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COLORED HEIRLOOM CORN AS A PUBLIC GOOD: THE CASE OF TLAXCALA, MEXICO

ABSTRACT. Valorization of territories with diverse cultures and heritage has multiplied in recent years. This study analyzes the case of colored heirloom corn in Tlaxcala, Mexico, as a potential public good associated with the region's biocultural heritage. The analysis conducted herein relies on a wide range of literature from relevant theory, including Geographical Indications, Global Value Chains, Community-Based Entrepreneurship, Public Goods, and Sustainable Development, in order to employ case study methodology. We leverage a novel approach to analyze the heirloom corn chain and its publicness. This chain reveals its status as a potential public good that clearly influences biocultural heritage, which has been preserved by several generations. To preserve colored heirloom corn in Tlaxcala, Mexico, a development strategy is needed that links actors and resources,

involves the public sector, and furthers expansion of the private sector. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

Velázquez-Salazar, M., Scalzo, G., & Shanks, C. B. (2021). Colored heirloom corn as a public good: The case of Tlaxcala, Mexico. *Sustainability* (Switzerland), 13(3), 1-16. Art. 1507. doi: 10.3390/su13031507. Article.

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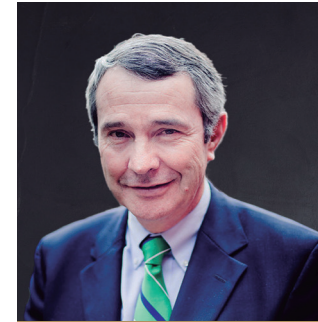
DESIGNATION OF ORIGIN DISTILLATES IN MEXICO: VALUE CHAINS AND TERRITORIAL DEVELOPMENT

ABSTRACT. Geographical Indications (GI) have been used in several countries, mainly in Europe, as tools to promote territorial development. These tools have been adopted in Latin American countries without serious reflection on their scope, limits, and advantages. One of the most relevant elements therein corresponds to the way in which these assets participate in value chains, whether short or long, which has important implications for governance, benefit distribution, geographic organization of value accumulation processes, among others. With that in mind, we identify the two most relevant Mexican GIs—namely Designation of Origin Tequila (DOT) and Designation of Origin Mezcal (DOM)—to analyze how their value chains have been constructed and their impact on territorial development. We conclude that GIs tend to adopt large value chains to satisfy long-distance demand, but they can have negative territorial effects if institutions are not strong enough to appropriately incorporate territorial stakeholders' demands. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

Pérez-Akaki, P., Vega-Vera, N. V., Enríquez-Caballero, Y. P., & Velázquez-Salazar, M. (2021). Designation of origin distillates in Mexico: Value chains and territorial development. *Sustainability* (Switzerland), 13(10). Art. 5496. doi: 10.3390/su13105496. Article.



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CLEMENTE DE JESUS MUNGUIA NUNEZ (MEXICO, 1810-68)

Abstract. his chapter offers a synthetic exposition of the main features of the life and work of Clemente de Jesús Munguía, known mainly for his tenacious work defending the rights of the Catholic Church against the secular liberal state, and for his writings of philosophy and theology. The biography is divided into three stages. The first (1810–40) corresponds to his childhood and youth and concludes with his graduation as a lawyer and his early professional practice in Morelia and Mexico City. The second (1841–51) begins with his ordination as a priest and continues with his work as rector at the Seminary of Morelia, where he profoundly reformed the curriculum and wrote his most important books on theology and moral philosophy. The third stage (1852–68) begins with his ordination as Bishop of Morelia, which generated political controversy over the oath that the government required for him to be ordained; this stage continues with his constant defense of the rights of the Church against the excessive pretensions of liberal governments and the government of Emperor Maximilian, and it concludes with his exile and death in Rome.

Goddard, J. A. (2021). Clemente de Jesus Munguia Nunez (Mexico, 1810-68). In M.C. Mirow & R. Domingo, *Law and Christianity in Latin America: The Work of Great Jurists* (pp. 188-202). Routledge. Book Chapter.

José Manuel Magaña Rufino

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WELL-KNOWN AND FAMOUS BRANDS PROTECTION IN ANDEAN COMMUNITY OF NATIONS (ACN)

[PROTECCIÓN DE LAS MARCAS NOTORIAS Y RENOMBRADAS O FAMOSAS EN LA COMUNIDAD ANDINA DE NACIONES (CAN)]

ABSTRACT. Apart from making the difference between competitor's products and services, trademarks provide prestige. In this way, the legal institutions of Well-Known and Famous Brands emerge. These brands require a higher legal protection than the re-quired for common brands. However, there is great confusion at the international level with respect to the wording and legal protection of these kinds of brands. This paper is intended to provide elements to clarify concepts related to this legal institutions, based on the applicable provisions within the Andean Community of Nations (ACN), as well as to analyze the legal protection hereof, and pos-

sible recommendations addressed to improve such legal protection. © 2020, Universidad Nacional Autónoma de México. All rights reserved.

Magaña Rufino, J. M. (2020). Well-known and famous brands protection in andean community of nations (Acn) [Protección de las marcas notorias y renombradas o famosas en la comunidad andina de naciones (Can)]. *Boletín Mexicano de Derecho Comparado*, 52(157), 193-220. doi: 10.22201/ijj.24484873e.2020.157.15229. Article.

Hugo Saúl Ramírez García

SNI Nivel II

INDIGENOUS PEOPLES' WAYS OF LIFE AND THE ENVIRONMENT: AN ECOFEMINIST AUTHORITY ASSERTION

[FORMAS DE VIDA DE LOS PUEBLOS ORIGINARIOS Y EL MEDIO AMBIENTE: UNA REIVINDICACIÓN DESDE EL ECOFEMINISMO]

ABSTRACT. What is the ecological value of the indigenous ways of life? For several years now, there has been a widespread conviction, at the institutional and academic levels, that indigenous or native ways of life are a resource for biodiversity conservation. In contrast to this idea, which leads to strategies with significant implicit dangers, this article defends the thesis that the way of life of the original peoples is a valuable experience that contributes to enhance the necessary wisdom to sustain those actions aimed to genuinely repair the current fracture between humanity and nature. With this in mind, the author explores ecofeminist proposals that offer grounds for acknowledging authority over experiences that have remained at the periphery of the modern mainstream: precisely those that are carried out by indigenous peoples.

Ramírez-García, H. S. (2020). Indigenous peoples' ways of life and the environment: an ecofeminist authority assertion [Formas de vida de los pueblos originarios y el medio ambiente: una reivindicación desde el ecofeminismo]. *Cuadernos de bioética*, 31(103), 331-342. doi: 10.30444/CB.73. Article.

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PRO PERSONA: GROUNDS AND MEANING OF THE LEGAL PRIMACY OF HUMANITY

[PRO PERSONA: FUNDAMENTO Y SENTIDO DE LA PRIMACÍA JURÍDICA DE LA HUMANIDAD]

ABSTRACT. With the recognition of human rights, the rule of law is committed to guide the practice

that legitimizes its existence towards the protection of the fundamental interests of every human being. The pro person principle is a prominent piece in this new historical stage of the rule of law, since its application has the potential to lead legal practice towards the achievement of substantive values. Considering the above, the central issue that this article seeks to understand points to the meaning and scope of the pro persona principle based on the following question: where is the radical and objective justification of its validity? © 2021 Universidade Federal do Paraná. All rights reserved.

Ramírez-García, H. S. (2021). Pro persona: Grounds and meaning of the legal primacy of humanity [Pro persona: Fundamento y sentido de la primacía jurídica de la humanidad]. *Revista de Investigaciones Constitucionales*, 8(2), 387-405. doi: 10.5380/rinc.v8i2.75450. Article.

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GENDER PARITY IN THE BOARDS OF DIRECTORS OF MEXICAN CORPORATIONS AND LIMITED LIABILITY COMPANIES)

[PARIDAD DE GÉNERO OBLIGATORIA EN LOS CONSEJOS DE ADMINISTRACIÓN DE LAS SOCIEDADES ANÓNIMAS Y DE RESPONSABILIDAD LIMITADA MEXICANAS]

ABSTRACT. Although our country has adopted a determined policy towards the equal participation of women in political, educational, health and economic activities, driven by institutions such as the United Nations (UN Women), the International Labor Organization (ILO), the European Commission (EC), the Organization for Economic Cooperation and Development (OECD) and other social organizations; However, neither the General Law on Mercantile Corporations (LGSM) nor the Securities Market Law (LMV) require female participation in the boards of directors (CA) of corporations, although there was a reform initiative that did not succeed and a second one presented in March 2019 subsists only for stock corporations (hereinafter SAB or listed). The absence of parity quotas in the CA makes the natural process of insertion of women in the fundamental decision making of companies and the exercise and effective enjoyment of their human rights of equal opportunities pitiful and tortuous, which, according to the Davos report (World Economic Forum, hereinafter FEM 2018, VIII), will require at least 60 years for the closing of the global gender gap in Mexico. © 2020, Universidad Nacional Autónoma de México. All rights reserved.

León Tovar, S. H. (2020). Gender parity in the boards of directors of mexican corporations and limited liability companies) [Paridad de género obligatoria en los consejos de administración de las sociedades anónimas y de responsabilidad limitada mexicanas]. *Boletín Mexicano de Derecho Comparado*, 53(158), 789-824. doi: 10.22201/ijj.24484873e.2020.158.15636. Article.



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THE RENAISSANCE RECEPTION OF NAHUA PAIDEIA IN THE WRITINGS OF BERNARDINO DE SAHAGÚN: AN AESTHETIC APPROACH TO RELIGION

ABSTRACT. In this article, I propose that books I–VI of Bernardino Sahagún's *Códice florentino*, which discuss the moral and religious philosophies of indigenous Mexicans, should be interpreted through the lens of Renaissance humanist linguistic and philosophical theories. I demonstrate that, utilizing Franciscan–Bonaventuran epistemology, Sahagún put forward a method of evangelizing that intended to separate “the good from the bad” in indigenous cultures. In an effort to defend my claim, I first lay out some of the problems surrounding the *Códice florentino*. Second, I describe the general theological and cosmological views held by the Aztecs, so that, third, I may develop the main principles of the philosophy of *flor y canto* (in *xochitl in cuicatl*). Against a political interpretation that is often defended by appealing to the traditional rituals performed in the Aztec empire, I contend that their philosophy should be interpreted from the perspective of Nahua religion and aesthetics. I also discuss Sahagún's reception of Aztec philosophy in the *Códice* with a focus on his interest in the linguistic and empirical dimensions of Nahua religion. © 2021 by the author. Licensee MDPI, Basel, Switzerland.

Armella, V. A. (2021). The renaissance reception of Nahua Paideia in the writings of Bernardino de Sahagún: An aesthetic approach to religion. *Religions*, 12(12). Art. 1070. doi: 10.3390/rel12121070. Article.

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ARTICULATING THE *DE MOTU ANIMALIUM*

ABSTRACT. This contribution locates the treatise *De Motu Animalium* within the Aristotelian oeuvre as a whole. It pays special attention to a section in *De Anima* III 10, where Aristotle announces another treatment that will deal with functions that are common to body and soul. Accordingly, the contribution tries to specify the kind of hylomorphism that is implied by this announcement.

Laks, A. (2020). Articulating the *De Motu Animalium*. In C. Rapp & O. Primavesi (eds.), *Aristotle's De Motu Animalium: Symposium Aristotelicum* (pp. 472–495). Oxford University Press. Book Chapter.

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WHAT IS COGNITIVE IN METAPHOR ACCORDING TO ARISTOTLE?

ABSTRACT. In the *Poetics* (21 1457b6 f.), Aristotle, defines metaphor as the transfer (epiphora) of a term from a given, foreign (allotrios) domain to another one. If, as does the classical doctrine of tropes, we consider that it substitutes the ‘proper’ term, the metaphor has a purely ornamental value and we can do without it. Modern theories insist, on the contrary, on the cognitive value of the metaphor: Because it offers a re-description of the world, the metaphor is “alive” (Paul Ricoeur). The question is to what extent this cognitive conception of metaphor, in spite of its classical reception, is already at work in Aristotle's differentiated analysis of the phenomenon, as Ricoeur claims. The answer is ‘yes but rather no’. This is because the cognition Aristotle talks about in relation to metaphor is of a special type, a “quasi-cognition”. © 2020 Imprensa da Universidade de Coimbra. All right reserved.

Laks, A. (2020). What is cognitive in metaphor according to Aristotle? [¿Qué es cognitivo en la metáfora según Aristóteles?]. *Revista Archai*, 30. Art. e03032. doi: 10.14195/1984-249X_30_32. Article.

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FRANCISCO SUÁREZ ON WOMEN'S RIGHT TO RULE

[ACERCA DEL DERECHO DE LA MUJER A GOBERNAR EN FRANCISCO SUÁREZ]

ABSTRACT. In book III of *De legibus*, Francisco Suárez claims that women can inherit and hold the political power to rule over a community. Men possess a natural dominion over women since women were created from them, according to Genesis. According to Francisco women possess a natural right to rule. If it is so, then it is false that women have an inferior nature to men by which they can only to inherit to their offspring the power to rule, but they cannot exert it. © 2021 Universidad Pontificia Comillas de Madrid. All rights reserved.

Rosales, M. L. (2021). Francisco suárez on women's right to rule [Acerca del derecho de la mujer a gobernar en francisco suárez]. *Pensamiento*, 77(294), 363–379. doi: 10.14422/pen.v77.i294.y2021.008. Article.

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AVICENNA ON INFORMATION PROCESSING AND ABSTRACTION

ABSTRACT. Avicenna has a great deal to say about the topic of ‘information’ (taṣawwur), that is, the acquisition of cognitive or mental content (ma'nā). Ma'nā is a term commonly used among Islamic scholars and could refer the meaning of a word, properties of the external world, and also cognitive or mental content (forms, images, intentions, intelligible forms, or concepts). Within his philosophical works, Avicenna developed sophisticated explanations for the human mind's ability to process information coming from the external world, as well as the way in which the mind (or ‘intellective soul,’ to use Avicenna's terminology) apprehends intelligible forms, that is, the highest form of cognitive content. Nevertheless, Avicenna provides two divergent models for human knowledge that scholarly literature has intensely debated between. In this chapter, I expand upon and problematize these two models. While I do not provide a resolution or a novel alternative interpretation to this discussion, I describe the status of the debate and ultimately evaluate if Avicenna's way of explaining cognition has something to say to contemporary epistemology.

López-Farjeat, L. X. (2021). Avicenna on information processing and abstraction. *Information and the History of Philosophy* (pp. 123–136). Taylor and Francis. Book Chapter.

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'ABD AL-JABBĀR AND AL-GHAZĀLĪ ON DIVINE SPEECH AND THEIR THEORIES OF LANGUAGE

ABSTRACT. Introduction. In 833 the Abbasid caliph al-Ma'mūn (d. 833) began a religious persecution known as the mihna against the opponents of the Mu'tazilite doctrine of the creation of the Qur'an. With al-Mu tasim (d. 842) and al-Wathiq (d. 847), the two successors of al-Ma' man, the persecution lasted for fifteen years. Around 849–850, al-Mutawakkil stopped enforcing the minna. As with most theological matters in the early Islamic context, doctrinal disagreements took place between Hanbalites, Mu'tazilites, and Ash'arites. In this case, while the Hanbalites held that the Qur'an was eternal and uncreated, containing the word of God-as Sunni Islam holds the Mu'tazilites taught that the Qur'an indeed is the

word of God but is created in time. The Ash'arites, for their part, represented an intermediate position in trying to argue in which sense the Qur'an is uncreated and in which sense it is not. Behind this theological controversy there are two key philosophical and theological issues, respectively, the definition of language and the way in which divine speech (kalam) should be understood. On the one hand, the Ash'arites and al-Ghazali (d. 1111) hold that divine speech is a divine essential attribute distinct from human speech; on the other hand, 'Abd al-Jabbar (d. 1025) representing the Mu'tazilite stance thinks language is not an essential attribute but something created and conventional (istilah) designed to transmit God's word. In this article I discuss the theories of language and divine speech behind the opposing positions regarding the createdness or [...].

López-Farjeat, L. X. (2021). 'Abd al-Jabbār and al-Ghazālī on Divine Speech and their Theories of Language. *Muslim World*, 111(3), 444–465. doi: 10.1111/muwo.12409. Article.



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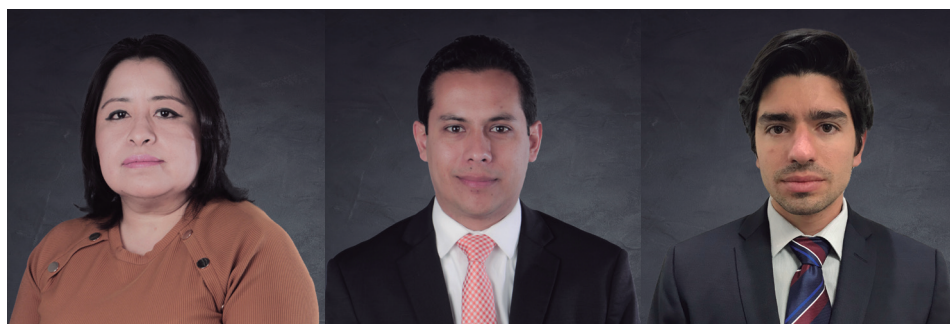


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SHAKING FORCE BALANCING OF THE 2RRR PPM SPECIFYING TOOL'S MOTION

ABSTRACT. Shaking force balancing of mechanisms usually is achieved by an optimal redistribution of the moving masses. This allows the cancellation or the reduction of the variable dynamic loads on the mechanism's frame. The procedure generally leads to a considerable increment in the mass. Addition of counterweights and counter-inertias are required, thus the driving torques and the shaking moment are incremented too. Recently the shaking force balancing has been successfully achieved by specifying the acceleration motion of the global Center of Mass (CoM) of the robot. Additional masses are avoided. But this may be difficult to apply in practice. Therefore it has been proposed a combined procedure, based on imposing an acceleration motion planning to the manipulator's tool, and on the selective mass redistribution. This last concept is resumed here using Natural Coordinates, a direct and easy to automate alternative. The force balancing of a 2RRR Planar Parallel Manipulator (PPM), also known as the five-bar mechanism, is used as an application example. The shaking force and the shaking moment are obtained analytically using the proposed direct approach. Linear relation between the acceleration of the CoM and the acceleration of the tool is shown in a clear and explicit way, making it easy to identify the required mass redistribution. A generic CAD model made in Solidworks is used to show the application of the technique and to validate the balancing's results, obtained from inverse kinematics simulations, through dynamic simulation. © 2022, The Author(s), under exclusive license to Springer Nature Switzerland AG.

Acevedo, M. & Velázquez, R. (2022). Shaking Force Balancing of the 2RRR PPM Specifying Tool's Motion. th International Symposium on Multibody Systems and Mechatronics, MuSMe 2021, virtual online. *Mechanisms and Machine Science*, 110, 181-190. doi: 10.007/978-3-030-88751-3_19. Conference Paper.

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EXPLORATORY DATA ANALYSIS OF THE VISITOR'S ARRIVALS TO CHICHEN-ITZÁS ARCHAEOLOGICAL SITE, A CASE STUDY

ABSTRACT. In recent years, Chichen-Itza's archaeological site importance has increased exponen-

tially. It receives more visitors every year. This has generated huge amounts of data only for the box office. In the current study, an exploratory data analysis is implemented on this dataset which covers from December 2016 to December 2018. From the results, it was observed that 73% of the visitors to the site are non-Mexicans. Meanwhile, 14.4% of the box office tickets are for national adults, divided between tickets sold during weekdays and tickets given on Sundays which are free for all nationals. The remaining 12.6% corresponds to tickets divided onto 11 different categories according to the current federal law. Different visitors behaviours were observed such as arrival times, season arrivals, and arrival time span. The results will allow for identifying strengths, weakness of the activities as well as possible threats. The insights obtained from this current exploratory data analysis will contribute to the development of competitiveness, and regional growth via decision and strategy making. © 2020 IEEE.

Avalos-Gauna, E., Palafox-Novack, L. F., & Carrasco-Yepez, D. (2020). Exploratory data analysis of the visitor's arrivals to Chichen-Itzäs archaeological site, a case study. 19th IEEE International Conference on Machine Learning and Applications, ICMLA 2020, Miami, Estados Unidos. *ICMLA*, 2020, 1199-1204. Art. 9356205. doi: 10.1109/ICMLA51294.2020.00189. Conference Paper.

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BIOPOLYMERS OBTAINED FROM ORANGE WASTE BASED ON A DECISION TREE

ABSTRACT. Organic waste is still of great value and its transformation into biodegradable polymers is part of the circular economy strategy. The main objective of this research was to evaluate different variables that were analyzed through a tree decision method in order to obtain a biomaterial developed through the conversion of orange peels into a biopolymer. The analysis and assessment include different particle sizes of the orange peel powder, different starch types, different cooling, and dehydration processes. The variables that resulted in the best biopolymer were as follows: particle size of the orange peel powder: 250 micrometers, potato starch and corn starch in a ratio of 0:100, cooling of

the mixture at room temperature, and finally the application of a dehydration process. © 2020 IEEE.

Berger P., Cachutt-Alvarado, C., Dominguez-Soberanes, J., Hernandez-Lozano, L. C., Ortega-Fraustro, D., Macías-Ochoa, M. F., & Licea-Domínguez, S. (2020). Biopolymers obtained from orange waste based on a decision tree. 2020 IEEE ANDESCON, ANDESCON 2020, Quito, Ecuador. *IEEE ANDESCON*, 2020. Art. 9271999. doi: 10.1109/ANDESCON50619.2020.9271999. Conference Paper.

Sara Margarita Camacho Navares

Profesora investigadora

VALUE ENGINEERING: DEFINITION OF FUNCTIONS THROUGH REQUIREMENTS AND SPECIFICATIONS ON PRODUCT DESIGN

ABSTRACT. The aim of this paper is to find a solution to determine functions without the need of a previous product. Frequently, engineering designers and designers must conceptualize, design and develop non-existing products, therefore using Value Engineering as a tool becomes a challenge since there is not a reference product to be analyzed. By providing a technique that allows them to understand what the product must do (through the use of functions) it should become easier to improve the product at an early stage, the conceptual design stage. The information available at this early stage is the one given at the information phase, hence the proposal is to define functions through requirements and specifications. Requirements are identified and classified by areas, these areas are named in a checklist built by Pahl and Beitz. Theory was applied to a Case Study for the development of a medical device designed to prevent lymphedema. Results showed that functions are possible to be determined through the requirements. © SAVE Inter. 2021 Value Summit Proc. All rights reserved.

Camacho-Navares, S. & Durán-Aguilar, G. (2021). Value engineering: Definition of functions through requirements and specifications on product design. SAVE International 2021 Value Summit, New Orleans, United States. *SAVE International*, 2021, 289-297. Conference Paper.

Fabiola Cortés Chávez

Profesora investigadora

Luis Alberto Rosa Sierra

SNI Nivel II

DESIGN PROCESS FOR A BIRTHING BED, BASED ON USER HIERARCHY: PROMOTING IMPROVEMENT IN USER SATISFACTION

ABSTRACT. The medical device design process

has a responsibility to define the characteristics of the object to ensure its correct interaction with users. This study presents a proposal to improve medical device design processes in order to increase user acceptance by considering two key factors: the user hierarchy and the relationship with the patient's health status. The goal of this study is to address this research gap and to increase design factors with practical suggestions for the design of new medical devices. The results obtained here will help medical device designers make more informed decisions about the functions and features required in the final product during the development stage. In addition, we aim to help researchers with design process didactics that demonstrate the importance of the correct execution of the process and how the factors considered can have an impact on the final product. An experiment was conducted with 40 design engineering students who designed birthing beds via two design processes: the traditional product design process and the new design process based on hierarchies (proposed in this study). The results showed a significant increase in the user acceptance of the new birthing bed developed with the hierarchical-based design process. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

Cortes-Chavez, F., Rossa-Sierra, A., & Gonzalez-Muñoz, E. L. (2021). Design process for a birthing bed, based on user hierarchy: Promoting improvement in user satisfaction. *Applied Sciences* (Switzerland), 11(20). Art. 9430. doi: 10.3390/app11209430. Article.

María Luisa Cruz López

Profesora investigadora

LAYER-ORIENTED CGH WITH ATTENUATED SPECKLE NOISE IN FOCUSED-LAYERS AND REDUCED DEFOCUS NOISE

ABSTRACT. In the layer-oriented computer-generated hologram, the diffraction of de-focused layers could introduce noise in other regions. We present a method for reducing the diffraction effects of de-focused layers and at the same time the method reduces the speckle noise in the focused layers. © OSA 2021, © 2021 The Author(s).

Cruz, M. L. (2021). Layer-oriented CGH with attenuated speckle noise in focused-layers and reduced defocus noise. *Applied Industrial Spectroscopy*, AIS 2021 - Part of Optical Sensors and Sensing Congress 2021, virtual online. *Optics InfoBase*, 2021. Art. JTU5A.24. Conference Paper.

María Luisa Cruz López

Profesora investigadora

SPECKLE-NOISE REDUCTION IN COMPUTER GENERATED HOLOGRAM, USING A MODULAR RANDOM PHASE PATTERN

ABSTRACT. We present a modular random phase pattern, which uses small blocks of random phase avoiding symmetries in small zones. This phase reduces the speckle noise in computer generated holograms and it is independent of the object. © OSA 2020 © 2020 The Author(s).

Cruz, M. L. (2020). Speckle-noise reduction in computer generated hologram, using a modular random phase pattern. 2020 Frontiers in Optics Conference, FIO 2020, Washington, United States. *Optics InfoBase*, 2020. Art. JTh4B.29. doi: 10.1364/FIO.2020.JTh4B.29. Conference Paper.

Héctor Gabriel Dávalos Alejo

SNI Nivel Candidato

A GROUND MOTION PREDICTION MODEL FOR AVERAGE SPECTRAL ACCELERATION

ABSTRACT. This study presents a ground motion prediction model that directly estimates the median and dispersion of Saavg, defined as the geometric mean of 5%-damped pseudo-acceleration ordinates of oscillators with periods between one fifth and three times the structure's period of vibration. This model is applicable for ground motions with moment magnitudes between 5 and 8 and Joyner-Boore distances between 0 km and 150 km. Results show that the dispersion of Saavg is lower than that of Sa(T1). A model to estimate the correlation between Saavg ordinates at different periods of vibration and between orthogonal components is also presented.

Dávalos, H. & Miranda, E. (2021). A Ground Motion Prediction Model for Average Spectral Acceleration. *Journal of Earthquake Engineering*, 25(2), 319-342. doi: 10.1080/13632469.2018.1518278. Article.

Héctor Gabriel Dávalos Alejo

SNI Nivel Candidato

ENHANCED TWO-STRIPE ANALYSIS FOR EFFICIENT ESTIMATION OF THE PROBABILITY OF COLLAPSE

ABSTRACT. An improved method to estimate the collapse fragility function of a structure is proposed. In the proposed method, referred to as

enhanced two-stripe analysis (E2SA), response history analyses are conducted at two ground motion intensity levels defined based on collapse risk deaggregation, the location of the lower intensity is updated based on results from analyses at the higher intensity and more analyses are conducted at the lower intensity level. Comparisons of this method with other proposals suggest that the proposed E2SA leads to a more efficient and more accurate estimation of the probability of collapse of a structure. © 2019 Taylor & Francis Group, LLC.

Dávalos, H. & Miranda, E. (2019). Enhanced Two-Stripe Analysis for Efficient Estimation of the Probability of Collapse. *Journal of Earthquake Engineering*, 25(11), 2325-2348. doi: 10.1080/13632469.2019.1628127. Article.

Héctor Gabriel Dávalos Alejo

SNI Nivel Candidato

ROBUSTNESS EVALUATION OF FIV3 USING NEAR-FAULT PULSE-LIKE GROUND MOTIONS

ABSTRACT. A robust intensity measure (IM) is one that provides stable structural response estimates when using ground motion records having a wide range of characteristics. This paper evaluates the robustness of collapse risk estimates of two 4-story structures using the new IM, FIV3, along with several ground motion sets having non- and pulse-like ground motions. Comparisons with the most common IM, the spectral acceleration at the first-mode period of the structure (Sa), Sa adjusted by ϵ , and Saavg, indicate that FIV3 is much more efficient, sufficient with respect to the pulse period ratio, and robust with respect to scale factor in the case of these low-rise moment frame buildings. Moreover, by using FIV3 the proportion of near-fault pulse-like ground motions included in the ground motion set or various characteristics of the ground motions have a minor influence in the results, meaning that results are far less sensitive to the ground motion set used in the evaluation than when other IMs are used. These results suggest that the ground motion selection process could be greatly simplified if FIV3 is used as the IM because deaggregation procedures aimed at estimating the 'correct' proportion of expected pulse-like ground motions or their pulse period distributions might no longer be necessary. © 2020 Elsevier Ltd.

Dávalos, H. & Miranda, E. (2021). Robustness evaluation of fiv3 using near-fault pulse-like ground motions. *Engineering Structures*, 230. Art. 111694. doi: 10.1016/j.engstruct.2020.111694. Article.

David Escobar Castillejos

SNI Nivel Candidato

THE PREDICTION OF ACADEMIC PERFORMANCE USING ENGINEERING STUDENT'S PROFILES

ABSTRACT. This article describes the determination of student profiles based on the constructs of multiple intelligences and on learning and affective strategies, in order to identify the most important characteristics for ensuring the academic success of engineering students. The two constructs were organized in terms of eight dimensions each: the basis for developing two questionnaires that were completed by 618 undergraduate engineering students, in an attempt to define their student profile. Three alternative measures were designed to determine numerical values for each dimension, according to their capacity to predict academic performance in terms of final grades, using regression analysis. According to the study's findings, the logical/mathematical dimension plays an important role in student performance, while anxiety has a negative effect on final grades. The definition of appropriate measures to determine students' cognitive, affective, and self-regulatory profiles can provide instructors with timely information to implement appropriate teaching strategies in their groups. © 2021.

Gonzalez-Nucamendi, A., Noguez, J., Neri, L., Robledo-Rella, V., García-Castellán, R. M. G., & Escobar-Castillejos, D. (2021). The prediction of academic performance using engineering student's profiles. *Computers and Electrical Engineering*, 93. Art. 107288. doi: 10.1016/j.compeleceng.2021.107288. Article.

David Escobar Castillejos

SNI Nivel Candidato

VIS-HAPT: A METHODOLOGY PROPOSAL TO DEVELOP VISUO-HAPTIC ENVIRONMENTS IN EDUCATION 4.0

ABSTRACT. Education 4.0 demands a flexible combination of digital literacy, critical thinking, and problem-solving in educational settings linked to real-world scenarios. Haptic technology incorporates the sense of touch into a visual simulator to enrich the user's sensory experience, thus supporting a meaningful learning process. After developing several visuo-haptic simulators, our team identified serious difficulties and important challenges to achieve successful learning environments within the framework of Education 4.0. This paper presents the VIS-HAPT methodology for developing realistic visuo-haptic scenarios to promote the learning of science and physics con-

cepts for engineering students. This methodology consists of four stages that integrate different aspects and processes leading to meaningful learning experiences for students. The different processes that must be carried out through the different stages, the difficulties to overcome and recommendations on how to face them are all described herein. The results are encouraging since a significant decrease (of approximately 40%) in the development and implementation times was obtained as compared with previous efforts. The quality of the visuo-haptic environments was also enhanced. Student perceptions of the benefits of using visuo-haptic simulators to enhance their understanding of physics concepts also improved after using the proposed methodology. The incorporation of haptic technologies in higher education settings will certainly foster better student performance in subsequent real environments related to Industry 4.0. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

Noguez, J., Neri, L., Robledo-Rella, V., García-Castellán, R. M. G., Gonzalez-Nucamendi, A., Escobar-Castillejos, D., & Molina, A. (2021). Vis-hapt: A methodology proposal to develop visuo-haptic environments in education 4.0. *Future Internet*, 13(10). 255. doi: 10.3390/fi13100255. Article.

Ricardo Abel Espinosa Loera

Profesor investigador

Hiram Eredín Ponce Espinosa

Investigador Titular D, SNI Nivel I

CLICK-EVENT SOUND DETECTION IN AUTOMOTIVE INDUSTRY USING MACHINE/DEEP LEARNING

ABSTRACT. In the automotive industry, despite the robotic systems on the production lines, factories continue employing workers in several custom tasks getting for semi-automatic assembly operations. Specifically, the assembly of electrical harnesses of engines comprises a set of connections between electrical components. Despite the task is easy to perform, employees tend not to notice that a few components are not being connected properly due to physical fatigue provoked by repetitive tasks. This yields a low quality of the assembly production line and possible hazards. In this work, we propose a sound detection system based on machine/deep learning (ML/DL) approaches to identify click sounds produced when electrical harnesses are connected. The purpose of this system is to count the number of connections properly made and to feedback to the employees. We collect and release a public dataset of 25,000 click sounds of 25 ms length at 22 kHz

during three months of assembly operations in an automotive production line located in Mexico. Then, we design an ML/DL-based methodology for click sound detection of assembled harnesses under real conditions of a noisy environment (noise level ranging from -16.67 dB to -12.87 dB) including other machinery sounds. Our best ML/DL model (i.e., a combination between five acoustic features and an optimized convolutional neural network) is able to detect click sounds in a real assembly production line with an accuracy of 94.55 ± 0.83 %. To the best of our knowledge, this is the first time a click sounds detection system in assembling electrical harnesses of engines for giving feedback to the workers is proposed and implemented in a real-world automotive production line. We consider this work valuable for the automotive industry on how to apply ML/DL approaches for improving the quality of semi-automatic assembly operations. © 2021 Elsevier B.V.

Espinosa, R., Ponce, H., & Gutiérrez, S. (2021). Click-event sound detection in automotive industry using machine/deep learning. *Applied Soft Computing*, 108. Art. 107465. doi: 10.1016/j.asoc.2021.107465. Article.

Ricardo Abel Espinosa Loera

Profesor investigador

RENEWABLE ENERGY PREDICTION THROUGH MACHINE LEARNING ALGORITHMS

ABSTRACT. This paper aims to implement an efficient renewable energy selection (either solar or wind) based on the chosen geographic location of Aguascalientes, Mexico through a Machine Learning (ML) method. Likewise, the information listed below will provide both a critical analysis and review of the state-of-the-art applications for ML Algorithms such as Support Vector Machines (SVM), Linear Regression (LR) and Neural Network Models (NNM). Rigorous data measurements taken over a period of six months, including those of solar irradiance, temperature, wind speed and wind direction to name a few, were the inputs used in different algorithms in order to find the one that could most accurately predict future weather conditions. Based on the obtained results, the best ML Algorithm ended up being Random Forest; an approach that is capable of building an accurate prediction through the calculation of two crucial parameters; Mean Square Error (MSE) and Mean Absolute Error (MAE). © 2020 IEEE.

Alvarez, L. F. J., Gonzalez, S. R., Lopez, A. D., Delgado, D. A. H., Espinosa, R., & Gutierrez, S. (2020). Renewable energy prediction through machine learning algorithms. 2020 IEEE ANDESCON, ANDESCON 2020, Quito, Ecuador. *IEEE ANDESCON*, 2020. Art. 9272029. doi: 10.1109/ANDESCON50619.2020.9272029. Conference Paper.

Héctor Eduardo Gilardi Velázquez

SNI Nivel Candidato

DESIGN PROCESS OF THE AVIONICS SUBSYSTEM OF COLIBRÍ MISSION: AN EXPERIENCE REPORT

ABSTRACT. Universidad Panamericana students are working in the design and build process of a nano-satellite, specifically a CubeSat, a common trend for the aerospace industry that started rising in the last decade. While many of the common problems of an aerospace mission are solved or diminished considerably by the CubeSat standards, there is still a lot of development required to reach each of the objectives of a particular mission, especially those focused on scientific research. Regarding the avionics subsystem, custom development is needed to allow for the integration of the payload subsystem, which is mission specific, as well as general-purpose Commercial Off The Shelf components. Providing a reliable, robust and efficient integration represents the biggest challenge for the design of the avionics subsystem. In this paper the avionics team presents experiences and challenges that they have faced and how they lead to the development of a completely new component, a Printed Circuit Board with a Field-Programmable Gate Array controlling, reading and sampling the fast and heavy data provided by the payload sensors in order to lighten, adequate and deliver the information to and for the satellite On Board Computer. Additionally, the interconnection between all electronic components of the satellite, at physical level (wiring design, environmental and electromagnetic compatibility), as well as the logical compatibility and feasibility of the components that will be exchanging commands and data through different communication protocols. Finally, this paper presents how Colibrí Mission has an academic impact since it had to solve those challenges without the experience that most CubeSat missions have, and how the spread of that knowledge opens the CubeSat industry to a country that previously was not able to participate on it. Copyright © 2021 The Authors. This is an open access article under the CC BY-NC-ND license (<https://creativecommons.org/licenses/by-nc-nd/4.0/>)

Munoz-Bassol, B., Munoz-Bassol, S., Estrella-Reyna, J. A., Gutierrez-De la Riva, A., Salinas-Miranda, M. A., Aguas-Fonseca, M., Spravkin-Galina, D., Majus-Garcia, M. P., Porras-Luraschi, P. A., & Gilardi-Velazquez, H. E. (2021). Design Process of the avionics subsystem of Colibrí mission: An experience report. IFAC Workshop on Aerospace Control Education WACE 2021, Milán, Italia. *IFAC-PapersOnLine*, 54(12), 94-98. doi: 10.1016/j.ifacol.2021.11.015. Conference Paper.

Héctor Eduardo Gilardi Velázquez

SNI Nivel Candidato

EMERGENCE OF SYNCHRONOUS BEHAVIOR IN A NETWORK WITH CHAOTIC MULTISTABLE SYSTEMS

ABSTRACT. In this work, we address the synchronization problem of complex dynamical networks with bidirectional, linear, and diffusive coupling, whose nodes have dynamics given by a particular class of piecewise linear (PWL) systems. The class of PWL systems are multistable unstable dissipative systems and exhibit chaotic behavior. The topologies that we consider are regular coupled network. Firstly, we consider that the complex network has a uniform coupling strength, and through the Lyapunov approach, we show that nodes can achieve complete or partial synchronization, where the synchronization solution depends on the inner coupling matrix and the initial conditions of each node. Secondly, we consider a weighted network, where the synchronization solution depends on the external coupling matrix, and even obtain a synchronous behavior type master-slave. Our theoretical results agree with the numerical simulations for a set of nodes in different topology networks. © 2021 Elsevier Ltd

Ruiz-Silva, A., Gilardi-Velázquez, H. E., & Campos, E. (2021). Emergence of synchronous behavior in a network with chaotic multistable systems. *Chaos, Solitons and Fractals*, 151. Art. 111263. doi: 10.1016/j.chaos.2021.111263. Article.

Héctor Eduardo Gilardi Velázquez

SNI Nivel Candidato

IMPLEMENTATION OF THE CFS FRAMEWORK FOR THE DEVELOPMENT OF SOFTWARE IN AEROSPACE MISSIONS: FIRST APPLICATION IN AN UNDERGRADUATE PROGRAM IN MEXICO

ABSTRACT. In recent years, the development of space missions with nanosatellites has had rapid growth, coupled with it, nanosatellite technology development including On Board Computer (OBC) and custom payloads. However, there are many difficulties to build satellites with specific purposes, such as severely limited resources and the development of software. In this paper, we propose using NASA's open-source Core Flight System (cFS) as the framework for software development in a space mission led by undergraduate students. By the comparison of viable options to develop the flight software, the advantages of using cFS are established. Furthermore, we also discuss some practical challenges in the deployment of flight software using cFS.

De la Vega-Martínez, M., Velázquez-García, M. C., Zavala-López, M. F., Hernández, E., Gutiérrez-Esparza, R. A., Arcos-Bravo, D. G., Medina, D., Gilardi-Velázquez, H. E., & McComas, D. (2021). Implementation of the cFS framework for the development of software in aerospace missions: first application in an undergraduate program in Mexico. *IFAC PapersOnLine*, 54(12), 88-93. doi: 10.1016/j.ifacol.2021.11.014. Conference Paper.

Roberto González Ojeda

Profesor investigador

Octavio Lozada Flores

SNI Nivel Candidato

HIGH-TEMPERATURE PRECIPITATION DESIGN-OF-EXPERIMENTS SIMULATION IN LOW-ALLOY CR-MO-NI HOT FORGING STEEL

ABSTRACT. The role of alloying elements such as Cr, Mo and Mn on low-alloy 8620 steel during hot forging operations is not yet clear, as, during deformation in the 1000-1100°C temperature range, the austenite grain size remains small, ensuring the capacity of the forged part to be subsequently modified by surface hardening procedures. This work analyzed a deformed bar considering hardness at different geometry zones, along with SEM and TEM microstructures of previous austenite grains and lamellar martensite spacing. Moreover, Thermocalc simulations of M7C3, M23C6 and MnS precipitation were combined with Design of Experiments (DOE) in order to detect the sensitivity and significant variables. The values of the alloying elements' percentages were drastically modified, as nominal values did not produce precipitation, and segregation at the austenite matrix may have been responsible for short-term, nanometric precipitates producing grain growth inhibition. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

Gonzalez-Ojeda, R., Lozada-Flores, O., Gonzalez-Reyes, G., & Sanchez-Moreno, J. M. (2021). High-temperature precipitation design-of-experiments simulation in low-alloy cr-mo-ni hot forging steel. *Metals*, 11(7). Art. 1054 doi: 10.3390/met11071054. Article.

Pilar Hernández Grageda

Profesora investigadora

CASE STUDY: ERGONOMIC ANALYSIS AND INTERVENTION OF A TRACTOR CABIN: IMPROVING ITS USABILITY AND REDUCING THE RISK OF PHYSICAL FATIGUE

ABSTRACT. There is a lack of information regarding the ergonomic principles that should be followed when designing the interior of a tractor cabin in order

for it to be comfortable, usable and safe. This design must take into account operator's characteristics such as his posture when driving, the forces that need to be applied when manipulating the instruments panel or the cognitive processes implied when the operator is interacting with the interior of the cabin. Since an ergonomic cabin can not only ensure the safety of the driver, but it can also help him/her to be more efficient in their daily activities, the objective of this report is to propose ergonomic interventions through literature research, suggesting a conceptual design that could improve the usability of a tractor cabin. Some decision-making methodologies such as Reverse brainstorming and Lightning Decision Jam are applied along the design process in order to evaluate and delimit the attributes of the new design that could best impact the positive experience of the tractor's operators. © 2021, The Author(s), under exclusive license to Springer Nature Switzerland AG.

Suárez-Gómez, G. D., Ramírez-Reynoso, J., Arévalo González, L., Flores-Espinoza, M. F., Díaz-Pinal, M., & Hernández-Grageda, P. (2021). Case Study: Ergonomic Analysis and Intervention of a Tractor Cabin: Improving Its Usability and Reducing the Risk of Physical Fatigue. 21st Congress of the International Ergonomics Association, IEA 2021, virtual online. *Lecture Notes in Networks and Systems*, 221, 269-273. doi: 10.1007/978-3-030-74608-7_34. Conference Paper.

Pilar Hernández Grageda

Profesora investigadora

DESIGN PROCESS OF A MOUNTABLE TOY BASED ON TOTAL DESIGN AND USER CENTERED DESIGN METHODOLOGIES

ABSTRACT. In this work we start from the idea that an isolated design methodology cannot be used with the purpose of simultaneously ensure usability outcomes and technical feasibility results. Since mountable toys are among the most used by young children nowadays, they were chosen to be the product that serves to validate how to apply a hybrid design method, using both User Centered Design and Total Design methodologies combined in an orderly and systematic process that can be replicated in future product design or redesign processes that seek, at the same time, to generate desirable products that match the needs of users, and that meet functionality standards. © 2022, The Author(s), under exclusive license to Springer Nature Switzerland AG.

Olivares Jiménez, A. S., Ibarra Caballero, M. I., Urías Dueñas, L. A., & Hernández-Grageda, P. (2022). Design Process of a Mountable Toy Based on Total Design and User Centered Design Methodologies. 21st Congress of the International Ergonomics Association, IEA 2021, virtual online. *Lecture Notes in Networks and Systems*, 223, 71-77. doi: 10.1007/978-3-030-74614-8_9. Conference Paper.

Pilar Hernández Grageda

Profesora investigadora

IMPROVEMENTS OF A TRACTOR CAB'S USABILITY BASED ON INTERACTION ANALYSIS AND ERGONOMICS ADJUSTMENTS

ABSTRACT. Being one of the main tools used in agriculture, tractors still cause physical fatigue in users and demand high cognitive processes. The main goal of this project is to detect interaction problems between the user and a chosen tractor cabin with the objective of applying ergonomic adjustments in order to improve the tractor's usability. As a result of applying ergonomic intervention strategies combined with design methods, a conceptual redesign for the main elements form the interior of a tractor cab: the front panel, the levers dashboard, and the seat was proposed. © 2021, The Author(s), under exclusive license to Springer Nature Switzerland AG.

Bátiz-Flores, T., Pérez, A., Escoto-Aceves, M. A., Martínez-López, M. F., & Hernández-Grageda, P. (2021). Improvements of a Tractor Cab's Usability Based on Interaction Analysis and Ergonomics Adjustments. 21st Congress of the International Ergonomics Association, IEA 2021, virtual online. *Lecture Notes in Networks and Systems*, 221, 193-199. doi: 10.1007/978-3-030-74608-7_25. Conference Paper.

Pilar Hernández Grageda

Profesora investigadora

INTERACTION ANALYSIS AND USABILITY ADJUSTMENTS IN CONCEPTUAL DESIGN OF A GENERIC TRACTOR CABIN

ABSTRACT. Considered to be the most used machinery in agriculture and forestry, and being the interior of a tractor's cabin the place where the user gets involved and develops most of the tasks every day at this industry, the design and construction of standard tractors cabins should contemplate ergonomic strategies and design principles in order to guaranty an improvement of the user's work efficiency, comfort, health, and safety based on tractor requirements standardized by SAE (Society of Automotive Engineers), ISO and safety range tests. The purpose of this job is to present a new proposal for the interior of a tractor's cabin based on a conceptual design, as a result of combining the findings of a literature review with design and decision-making methodologies, providing visual, biomechanics, posture, and tool simplification refinements in the frontal panel, multipurpose accessories' area, lever system, and the seat. © 2021, The Author(s), under exclusive license to Springer Nature Switzerland AG.

Villalpando-Chávez, N., Vázquez-Hernández, C., Aldana-Castillo, M. F., & Hernández-Grageda, P. (2021). Interaction Analysis and Usability Adjustments in Conceptual Design of a Generic Tractor Cabin. *Lecture Notes in Networks and Systems*, 221, 284-290. doi: 10.1007/978-3-030-74608-7_36. Conference Paper.

Pilar Hernández Grageda

Profesora investigadora

MERGING TOTAL DESIGN AND USER CENTERED DESIGN FOR DESIGNING A MOUNTABLE TOY: ACHIEVING A USEFUL, FUNCTIONAL AND DESIRABLE PRODUCT

ABSTRACT. Through a hybrid design model that fuses key elements of the Total Design and User Centered Design approach and focusing on the safety of the child in and out of the water, cooperative socialization and a timeless life cycle as main design aspects, we developed a terrestrial-aquatic ride on toy proposal which generates feelings of attachment, unforgettable memories and an emotional bond with the product. Playing is extremely essential for fulfilling early childhood development needs and ride on toys promote a complete socialization in early stages. We accomplished all design requirements with this new hybrid design methodology centered both in the user and in the functional value of the product; resulting in a product that enhances a strong emotional bond and a better life cycle, achieving a desirable, useful and valuable product. © 2022, The Author(s), under exclusive license to Springer Nature Switzerland AG.

Covarrubias Cruz, J. M., De La Rocha Barbosa, M. F., Santos Rivera, F., & Hernández-Grageda, P. (2022). Merging Total Design and User Centered Design for Designing a Mountable Toy: Achieving a Useful, Functional and Desirable Product. 21st Congress of the International Ergonomics Association, IEA 2021, virtual online. *Lecture Notes in Networks and Systems*, 223, 54-61. doi: 10.1007/978-3-030-74614-8_7. Conference Paper.

Carlos Daniel Laguna Juárez

Profesor investigador

COLIBRÍ MISSION: HOW TO BOOST THE MEXICAN SPACE INDUSTRY BY INVOLVING THE GENERAL PUBLIC INTO THE DEVELOPMENT OF A SPACE PROGRAM

ABSTRACT. Colibrí Mission is one of the first space missions developed by undergraduate students in Mexico, which seeks to make significant contributions to the development of a national space industry. It is designing and building a nanosat-

ellite dedicated to scientific research on Earth's Lower Atmosphere. In a country with a nascent space industry, it is important not only to manage and attract talented individuals capable of conducting scientific and technical research, but also to serve key audiences that can contribute to the Mission's fundraising objectives and promote scientific and technological knowledge among Mexican society, in particular its youth. With limited access to government space funding, these outreach programs sustain important sponsor-seeking efforts to bring the Mission to life. This paper presents an example of the implementation of transmedia in a space program's communication strategy. The two main objectives -public outreach and fundraising- were achieved by generating brand awareness and managing key specific stakeholders. Adapting a public relations model and utilizing the methodology proposed by Colin Eden and Fran Ackermann (2010) to map stakeholders, Colibrí Mission's strategy seeks to influence key stakeholders to better suit the Mission's needs and transmit the experience of what it means to belong to a Mexican space mission. The implementation of the transmedia strategy resulted in: influencing key stakeholders by increasing their interest to help the team as two context setters moved to key player positions; gaining sponsors and allies that previously did not exist; and an increase in public outreach, brand recognition and followers on social media platforms. © 2020 by DLR-SART.

Rodríguez-Martínez, D., Robles, S., & Laguna-Juárez, C. (2020). Colibrí mission: How to boost the Mexican space industry by involving the general public into the development of a space program. 71st International Astronautical Congress, virtual online. *IAC*, 2020. Conference Paper.

Juan Carlos López Pimentel

Profesor investigador

Omar Guillermo Rojas Altamirano

Investigador Titular D, SNI Nivel I

BLOCKCHAIN AND OFF-CHAIN: A SOLUTION FOR AUDIT ISSUES IN SUPPLY CHAIN SYSTEMS

ABSTRACT. Even though there are researchers focused on implementing blockchain in auditing aspects, some data is cumbersome, and storing it on a blockchain requires too much computational cost. That's where a hybrid solution would be better. We aim to provide a blockchain-off-chain mechanism in the supply chain area. This paper presents an audit mechanism that, in the first instance, saves all the events (records) of a supply chain within a blockchain in a hashed form. In a second instance,

users of a supply chain system can query integrity, data provenance, and traceability to blockchain through an intermediate server that establishes communication between blockchain and the supply chain. Our proposal has been validated employing a proof of concept where, some avocado supply chain services have been implemented using a microservices architecture. © 2020 IEEE.

Lopez-Pimentel, J. C., Rojas, O., & Monroy, R. (2020). Blockchain and off-chain: A Solution for Audit Issues in Supply Chain Systems. 3rd IEEE International Conference on Blockchain, Blockchain 2020, virtual online, Rhodes Island, Greece. *Proceedings-2020 IEEE International Conference on Blockchain*, 2020, 126-133. Art. 9284759. doi: 10.1109/Blockchain50366.2020.00023. Conference Paper.

Juan Carlos López Pimentel

Profesor investigador

ROOTLOGCHAIN: REGISTERING LOG-EVENTS IN A BLOCKCHAIN FOR AUDIT ISSUES FROM THE CREATION OF THE ROOT

ABSTRACT. Logging system activities are required to provide credibility and confidence in the systems used by an organization. Logs in computer systems must be secured from the root user so that they are true and fair. This paper introduces RootLogChain, a blockchain-based audit mechanism that is built upon a security protocol to create both a root user in a blockchain network and the first log; from there, all root events are stored as logs within a standard blockchain mechanism. RootLogChain provides security constructs so as to be deployed in a distributed context over a hostile environment, such as the internet. We have developed a prototype based on a microservice architecture, validating it by executing different stress proofs in two scenarios: one with compliant agents and the other without. In such scenarios, several compliant and non-compliant agents try to become a root and register the events within the blockchain. Non-compliant agents simulate eavesdropper entities that do not follow the rules of the protocol. Our experiments show that the mechanism guarantees the creation of one and only one root user, integrity, and authenticity of the transactions; it also stores all events generated by the root within a blockchain. In addition, for audit issues, the traceability of the transaction logs can be consulted by the root. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

López-Pimentel, J. C., Morales-Rosales, L. A., & Monroy, R. (2021). Rootlogchain: Registering log-events in a blockchain for audit issues from the creation of the root. *Sensors*, 21(22). Art. 7669. doi: 10.3390/s21227669. Article.

Juan Carlos López Pimentel

Profesor investigador

Miguel Alcaraz Rivera

Profesor investigador

SECURE DISTRIBUTED NETWORK MODEL TO STORE VEHICLE TRANSACTION RECORDS THROUGH BLOCKCHAIN PLATFORM

ABSTRACT. Blockchain is an emergent technology applied initially to cryptocurrencies, but with a much further reach. We present a secure, transaction-based system that handles motorized vehicle provenance (including ownership) over a distributed model using smart contracts on a blockchain. The system model includes the specification of various security protocols, verified using AVIS-PA-SPAN tool and guaranteeing privacy, authenticity, and other security features. A client of the system can have different roles accordingly to the relationship it has with the vehicle, and it can get various services and request transactions accordingly. Our proposal might contribute to reduce fraud and expand the applications of Blockchain. © 2020 IEEE.

Carlos Lopez-Pimentel, J. & Alcaraz Rivera, M. (2020). Secure Distributed Network Model to Store Vehicle Transaction Records through Blockchain Platform. 3rd IEEE International Conference on Blockchain, Blockchain 2020, virtual online, Rhodes Island, Greece. *Proceedings-2020 IEEE International Conference on Blockchain*, 2020, 359-364. Article 9284712. doi: 10.1109/Blockchain50366.2020.00052. Conference Paper.

José Antonio Marmolejo Saucedo

SNI Nivel II

Isabel Joaquína Niembro García

Profesora investigadora

A LIFE CYCLE ASSESSMENT (LCA) OF ANTIBACTERIAL GEL PRODUCTION

ABSTRACT. During the COVID-19 pandemic the antibacterial gel become an important prevention measures to stop the spread of the virus. In Mexico, the demand for preventive hygiene products and health supplies increased more than 50% at the beginning of the pandemic. With the concern of knowing the negative impacts that the high demands of this product can cause to the environment, we took on the task of looking for life cycle assessment (LCA) studies related to the production of antibacterial gel, it was unexpected not to find any scientific information reported about the subject. This paper takes as one of its main motivation the lack of information to

accomplish an LCA which is used to evaluate the negative environmental impacts associated with the products or services. The aim of this paper is elaborate an LCA study of the antibacterial gel, a substance widely used during the COVID-19 pandemic, to assess the environmental impacts from its production. We focus on a case study involving the antibacterial gel from a company in Mexico. We completed the inventory analysis in collaboration with the company and compiled the impact assessments using the GaBi software and the ReCiPe method. The results shows that the principal impact categories of the antibacterial gel production are the Climate Change, Ozone Depletion, Fossil Depletion and Human Toxicity. © 2021, ICST Institute for Computer Sciences, Social Informatics and Telecommunications Engineering.

Enríquez-Martínez, V., Niembro-García, I. J., & Marmolejo-Saucedo, J. A. (2021). A Life Cycle Assessment (LCA) of Antibacterial Gel Production. 5th EAI International Conference on Computer Science and Engineering in Health Services, COMPSE 2021, virtual online. *LNICST*, 393, 12-27. doi: 10.1007/978-3-030-87495-7_2. Conference Paper.

José Antonio Marmolejo Saucedo

SNI Nivel II

A METAHEURISTIC APPROACH AND MATHEMATICAL PROGRAMMING FOR PACKING OBJECTS IN A RECTANGULAR CONTAINER

ABSTRACT. The problem of packing non-congruent circles within bounded regions is considered. The aim is to maximize the number of circles placed into a rectangular container or minimize the waste. The circle is considered as a set of points that are all the same distance (not necessarily Euclidean) from a given point. An integer programming model is proposed using a dotted-board approximating the container and considering the dots as potential positions for assigning centers of the circles. The packing problem is then stated as a large scale linear 0-1 optimization problem. Binary decision variables are associated with each discrete point of the board (a dot) and with each object. Then, the same grid is used to prove a population-based metaheuristic. This metaheuristic is inspired by the monkeys' behavior. The resulting binary problem is then solved by using Gurobi Solver and Python Programming Language as Interface. Copyright © 2020, IGI Global.

Torres-Escobar, R., Marmolejo-Saucedo, J. A., & Litvinchev, I. (2020). A metaheuristic approach and mathematical programming for packing objects in a rectangular container. *International Journal of Applied Metaheuristic Computing*, 11(3), 1-40. doi: 10.4018/IJAMC.2020070106. Article.

José Antonio Marmolejo Saucedo

SNI Nivel II

A NEAREST NEIGHBOR ALGORITHM TO OPTIMIZE RECYCLING NETWORKS

ABSTRACT. This article analyses the processes of collecting used non-returnable packaging to improve the recycling of material. A collection system is proposed by applying a profitable visit algorithm based on the widely-known Nearest Neighbor Algorithm. A comparative study is performed to achieve a higher volume of recycled material while decreasing the cost of collection. The proposed algorithm shows a much better performance than the reference. The developed algorithm was evaluated in a real scenario and confirmed by a simulation runs. Savings in material sourcing processes can be achieved in real operations. The proposed algorithm shows some advantage. Copyright © 2020, IGI Global.

Monsreal-Barrera, M. M., Cruz-Mejía, O., & Marmolejo-Saucedo, J. A. (2020). A nearest neighbor algorithm to optimize recycling networks. *International Journal of Applied Metaheuristic Computing*, 11(3), 1-40. doi: 10.4018/IJAMC.2020070105. Article.

José Antonio Marmolejo Saucedo

SNI Nivel II

Román Rodríguez Aguilar

SNI Nivel II

A NESTED UNSUPERVISED LEARNING MODEL FOR CLASSIFICATION OF SKU'S IN A TRANSNATIONAL COMPANY: A BIG DATA MODEL

ABSTRACT. This work seeks to develop a nested non-supervised model that allows a transnational soft drink company to improve its decision-making for the discontinuation of products from its portfolio with the use of unsupervised models from a database with commercial and financial information for all your product line in your most important operation. The integration of different cluster methodologies through a nested non-supervised model allowed to generate a correct identification of the products that should be refined from the catalog due to financial and operational factors. Given the magnitude of the information, a cluster was integrated into a platform for data processing as well as the generation of automatic reports that could be consulted automatically through the cloud. The products identified through the nested unsupervised model made it possible to identify products that had low demand and a low contribution to the utility of the company. Removing said products from the catalog will allow maximizing the profit of the business in addition to not incur-

ring sunk costs related to the production and distribution of low-demand products. The platform developed will allow continuous monitoring of business performance in order to automatically identify the products likely to leave the catalog. © 2021, The Author(s), under exclusive license to Springer Nature Switzerland AG.

Loy-García, G., Rodríguez-Aguilar, R., & Marmolejo-Saucedo, J. A. (2021). A Nested Unsupervised Learning Model for Classification of SKU's in a Transnational Company: A Big Data Model. In F. Xhafa (ed.), *Lecture Notes on Data Engineering and Communications Technologies*, vol. 76, (pp. 715-731). Springer. doi: 10.1007/978-3-030-79357-9_66. Book Chapter.

José Antonio Marmolejo Saucedo

SNI Nivel II

A SET-PARTITIONING-BASED MODEL TO SAVE COST ON THE IMPORT PROCESSES

ABSTRACT. Complying with standards as part of the process of importing products within the supply chain is important, as it is a requirement that must be met to continue with the flow of the chain. In addition, it ensures compatibility in operation, voltage, power, amperage in the home and business, etc. Issuance of certificates varies in cost as a result of the way the product family is grouped, tested and measured. The following research proposes a mathematical model, based on the Set Partitioning Problem, which makes groups by product families. Thus obtaining a significant reduction of stationery, tests and costs associated with this process for products to be imported and marketed in the country. Several test cases will be presented and a comparison will be made between the current empirical process and the proposed mathematical model. © Springer International Publishing AG 2018.

Saucedo-Martínez, J. A., Marmolejo-Saucedo, J. A., & Vasant, P. (2018). A set-partitioning-based model to save cost on the import processes. *Studies in Computational Intelligence*. 1st International Conference on the Computer Science and Engineering, COMPSE 2016. *Studies in Computational Intelligence*, 741, 57-72. doi: 10.1007/978-3-319-66984-7_4. Conference Paper.

José Antonio Marmolejo Saucedo

SNI Nivel II

Isabel Joaquína Niembro García

Profesora investigadora

A SYSTEMATIC LITERATURE REVIEW OF QUANTITATIVE MODELS FOR SUSTAINABLE SUPPLY CHAIN MANAGEMENT

ABSTRACT. Supply chain management is the basis for the execution of operations, being considered

as the core of the business function in the 21st century. On the other hand, at present, factors such as the reduction of natural resources, the search for competitive advantages, government laws and global agreements, have generated a greater interest in the sustainable development, which, in order to achieve it, industries need to rethink and plan their supply chain considering a path of sustainability. So sustainable supply chain management emerges as a means to integrate stakeholders' concern for profit and cost reduction with environmental and social requirements, attracting significant interest among managers, researchers and practitioners. The main objective of this study is to provide a synthesis of the key elements of the quantitative model offerings that use sustainability indicators in the design and management of forward supply chains. To achieve this objective, we developed a systematic literature review that includes seventy articles published during the last decade in peer-reviewed journals in English language. In addition a 4 Vs analysis (When, Who, What, and Where) is applied and three structural dimensions are defined and grouped by categories: Supply chain management, modeling and sustainability. As part of the results we evidenced a continuous growth in the scientific production of this type of articles, with a predominance of deterministic mathematical programming models with an environmental economic perspective. Finally, we identified research gaps, highlighting the lack of integral inclusion of a life cycle analysis in the design of supply chain networks. © 2021 the Author(s), licensee AIMS Press.

Flores-Sigenza, P., Marmolejo-Saucedo, J. A., Niembro-García, J., & Lopez-Sanchez, V. M. (2021). A systematic literature review of quantitative models for sustainable supply chain management. *Mathematical Biosciences and Engineering*, 18(3), 2206-2229. doi: 10.3934/mbe.2021111. Article.

José Antonio Marmolejo Saucedo

SNI Nivel II

A TWO STAGE METHOD FOR THE MULTIPLE TRAVELING SALESMAN PROBLEM

ABSTRACT. The variation of the traveling salesman problem (TSP) with multiple salesmen (m-TSP) has been studied for many years resulting in diverse solution methods, both exact and heuristic. However, the high difficulty level on finding optimal (or acceptable) solutions has opposed the many efforts of doing so. The proposed method regards a two stage procedure which implies a modified version of the p-Median Problem (PMP) alongside the TSP, making a partition of the nodes into subsets that will be assigned to each salesman, solving it with Branch

& Cut (B&C), in the first stage. This is followed by the routing, applying an Ant Colony Optimization (ACO) metaheuristic algorithm to solve a TSP for each subset of nodes. A case study was reviewed, detailing the positioning of five vehicles in strategic places in the Mexican Republic. Copyright © 2020, IGI Global.

Cuevas, A. M. C., Martínez, J. A. S., & Saucedo, J. A. M. (2020). A two stage method for the multiple traveling salesman problem. *International Journal of Applied Metaheuristic Computing*, 11(3), 1-40. doi: 10.4018/IJAMC.2020070104. Article.

José Antonio Marmolejo Saucedo

SNI Nivel II

Román Rodríguez Aguilar

SNI Nivel II

DESIGN OF A LOGISTICS NETWORK USING ANALYTICAL TECHNIQUES AND AGENT-BASED SIMULATION

ABSTRACT. Business Logistics, or Supply Chain, has acquired a notorious relevance in current business management, due to its highly significant impact on the success of the production and service sectors. This work proposes the design of a supply chain that considers disruptive scenarios and improves the level of service compared to the current situation. Discrete event simulation techniques are used in conjunction with agent-based modeling to define production orders. A hypothetical case study was developed to show the performance of the proposal. © 2021, ICST Institute for Computer Sciences, Social Informatics and Telecommunications Engineering.

Marmolejo-Saucedo, J. A., Rodríguez-Aguilar, R., Callejas, G. M., Urbieto M. S. K., Acasuso, S. F. P., & Girault, J. P. G. (2021). Design of a Logistics Network Using Analytical Techniques and Agent-Based Simulation. 5th EAI International Conference on Computer Science and Engineering in Health Services, COMPSE 2021. *LNICST*, 393, 216-224. doi: 10.1007/978-3-030-87495-7_14. Conference Paper.

José Antonio Marmolejo Saucedo

SNI Nivel II

HUB LOCATION PROBLEM FOR MEDICAL CARE DURING EPIDEMIC OUTBREAKS

ABSTRACT. This paper presents a proposal for the Hub location for medical care during epidemic outbreaks. A problem of coverage of medical services that offers a radius of medical attention to the population is analyzed. Two criteria are shown for the location of health services. Finally, based on public health policy recommendations, the solution is proposed for a hypothetical case. ©

2021, ICST Institute for Computer Sciences, Social Informatics and Telecommunications Engineering.

Marmolejo-Saucedo, J. A. & Rojas-Arce, J. (2021). Hub Location Problem for Medical Care During Epidemic Outbreaks. 4th EAI International Conference on Computer Science and Health Engineering in Health Services, COMPSE 2020, virtual online. *LNICST*, 359, 117-129. doi: 10.1007/978-3-030-69839-3_8. Conference Paper.

José Antonio Marmolejo Saucedo

SNI Nivel II

Román Rodríguez Aguilar

SNI Nivel II

IDENTIFICATION OF TRADING STRATEGIES USING MARKOV CHAINS AND STATISTICAL LEARNING TOOLS

ABSTRACT. Technological advances have modified many operational and strategic areas in companies, the financial sector has been one of the sectors highly influenced by the methods of artificial intelligence and machine learning. The operation in the stock exchanges have used more technological tools to process information and be able to make investment decisions. The main objective is to be able to detect buying and selling opportunities at the right time. Stock markets have traditionally based their decisions on two major approaches, technical analysis and fundamental analysis, with new machine learning and artificial intelligence technologies, these paradigms have been updated making use of additional tools for their analysis. The present work is a proposal for the detection of trading signals in the markets through the use of Markov models and generalized additive models. In order to identify investment opportunities in the stock markets. © 2021, The Author(s), under exclusive license to Springer Nature Switzerland AG.

Rodríguez-Aguilar, R. & Marmolejo-Saucedo, J.-A. (2021). Identification of Trading Strategies Using Markov Chains and Statistical Learning Tools. *Lecture Notes on Data Engineering and Communications Technologies*, vol. 76, (pp. 732-741). Springer. doi: 10.1007/978-3-030-79357-9_67. Book Chapter.

José Antonio Marmolejo Saucedo

SNI Nivel II

IMPORTANCE OF ORGANIZATIONAL STRUCTURE FOR TQM SUCCESS AND CUSTOMER SATISFACTION

ABSTRACT. This paper reports a structural equation model to relate three critical success factors for total quality management (TQM) (i.e. mana-

gerial commitment, role of quality department, and quality policies) with customer satisfaction benefits through six hypotheses, which are statistically tested with information from 398 responses to a survey applied to Mexican manufacturing industry and using partial least squares technique integrated in WarpPLS v.6 software. The paper also reports a sensitivity analysis based on conditional probabilities for analyze low and high scenarios. Findings indicate that managerial commitment is the most important variable to ensure TQM, yet it depends on the role of the quality department for deploy quality policies and guarantee customer satisfaction. Similarly, sensibility analysis demonstrate that high levels of managerial commitment always guarantee a high performance in quality departments and good quality policies, thereby contributing to customer satisfaction. From this perspective, there are statistical evidence to declare that managers and operators are the main facilitators of TQM success. © 2019, Springer Science+Business Media, LLC, part of Springer Nature.

García-Alcaraz, J. L., Montalvo, F. J. F., Sánchez-Ramírez, C., Avelar-Sosa, L., Saucedo, J. A. M., & Alor-Hernández, G. (2019). Importance of organizational structure for TQM success and customer satisfaction. *Wireless Networks*, 27(3), 1601-1614. doi: 10.1007/s11276-019-02158-5. Article.

José Antonio Marmolejo Saucedo

SNI Nivel II

Román Rodríguez Aguilar

SNI Nivel II

IMPROVING A MANUFACTURING PROCESS USING RECURSIVE ARTIFICIAL INTELLIGENCE

ABSTRACT. This work explores the improvements that can be made in the process of parametrization of discrete-event simulation models. A manufacturing process is modeled through queuing systems and alternative decisions to perform production, transport, and merchandise handling tasks. The use of recursive artificial intelligence is suggested to improve the quality of the parameters used in the simulation model. Specifically, a vector support machine is used for statistical learning. A relevant characteristic of the proposed model is the integration of different information technology platforms so that the simulation can be recursive. © 2021, IFIP International Federation for Information Processing.

Marmolejo-Saucedo, J. A., Rodríguez-Aguilar, R., Perea, U. A. R., Vaquero, M. G., Hernández, R. R., Ramírez, F. S., & Martínez, A. P. (2021). Improving a Manufacturing Process using Recursive Artificial Intelligence. IFIP WG 5.7 International Conference on Advances in Production Management Systems, APMS 2021, Nantes, France. *IFIP*, 633, 266-275. doi: 10.1007/978-3-030-85910-7_28. Conference Paper.

José Antonio Marmolejo Saucedo

SNI Nivel II

OPTIMIZED FILLING OF A GIVEN CUBOID WITH SPHERICAL POWDERS FOR ADDITIVE MANUFACTURING

ABSTRACT. In additive manufacturing (also known as 3D printing), a layer-by-layer buildup process is used for manufacturing parts. Modern laser 3D printers can work with various materials including metal powders. In particular, mixing various-sized spherical powders of titanium alloys is considered most promising for the aerospace industry. To achieve desired mechanical properties of the final product, it is necessary to maintain a certain proportional ratio between different powder fractions. In this paper, a modeling approach for filling up a rectangular 3D volume by unequal spheres in a layer-by-layer manner is proposed. A relative number of spheres of a given radius (relative frequency) are known and have to be fulfilled in the final packing. A fast heuristic has been developed to solve this special packing problem. Numerical results are compared with experimental findings for titanium alloy spherical powders. The relative frequencies obtained by using the imposed algorithm are very close to those obtained by the experiment. This provides an opportunity for using a cheap numerical modeling instead of expensive experimental study. © 2020, Operations Research Society of China, Periodicals Agency of Shanghai University, Science Press, and Springer-Verlag GmbH Germany, part of Springer Nature.

Duriagina, Z., Lemishka, I., Litvinchev, I., Marmolejo, J. A., Pankratov, A., Romanova, T., & Yaskov, G. (2020). Optimized Filling of a Given Cuboid with Spherical Powders for Additive Manufacturing. *Journal of the Operations Research Society of China*, 9(4), 853-868. doi: 10.1007/s40305-020-00314-9. Article.

José Antonio Marmolejo Saucedo

SNI Nivel II

Román Rodríguez Aguilar

SNI Nivel II

QUANTUM-BEHAVED BAT ALGORITHM FOR SOLVING THE ECONOMIC LOAD DISPATCH PROBLEM CONSIDERING A VALVE-POINT EFFECT

ABSTRACT. Quantum computing-inspired metaheuristic algorithms have emerged as a powerful computational tool to solve nonlinear optimization problems. In this paper, a quantum-behaved bat algorithm (QBA) is implemented to solve a nonlinear economic load dispatch (ELD) problem. The objective of ELD is to find an optimal combination of power generating units in order to mini-

mize total fuel cost of the system, while satisfying all other constraints. To make the system more applicable to the real-world problem, a valve-point effect is considered here with the ELD problem. QBA is applied in 3-unit, 10-unit, and 40-unit power generation systems for different load demands. The obtained result is then presented and compared with some well-known methods from the literature such as different versions of evolutionary programming (EP) and particle swarm optimization (PSO), genetic algorithm (GA), differential evolution (DE), simulated annealing (SA) and hybrid ABC_PSO. The comparison of results shows that QBA performs better than the above-mentioned methods in terms of solution quality, convergence characteristics and computational efficiency. Thus, QBA proves to be an effective and a robust technique to solve such nonlinear optimization problem. Copyright © 2020, IGI Global.

Vasant, P., Mahdi, F. P., Marmolejo-Saucedo, J. A., Litvinchev, I., Aguilar, R. R., & Watada, J. (2020). Quantum-behaved bat algorithm for solving the economic load dispatch problem considering a valve-point effect. *International Journal of Applied Metaheuristic Computing*, 11(3), 1-40. doi: 10.4018/IJAMC.2020070102. Article.

José Antonio Marmolejo Saucedo

SNI Nivel II

TELEREHABILITATION PROTOTYPE FOR POSTURAL DISORDER MONITORING IN PARKINSON DISEASE

ABSTRACT. The present work shows a telerehabilitation prototype for the monitoring of postural disorders in patients with Parkinson's disease. The design of this prototype originated from a proposal for the identification of business ideas in medical devices. Specifically, the steps that were followed were to detect a need, formulate hypotheses about the problem and the client who faces them in their day-to-day life, then validate them through interviews with clients, to formulate the hypothesis of the solution; and build a prototype that offers value and solves previously detected needs. This prototype allows to make measurements, and eventually corrections of the postures in patients with Parkinson's disease, using devices that can be used remotely as part of the interaction between the doctor and the patient. © 2021, ICST Institute for Computer Sciences, Social Informatics and Telecommunications Engineering.

Rojas-Arce, J. L., Jimenez-Angeles, L., & Marmolejo-Saucedo, J. A. (2021). Telerehabilitation Prototype for Postural Disorder Monitoring in Parkinson Disease. 5th EAI International Conference on Computer Science and Engineering in Health Services, COMPSE 2021, virtual online. *LNICST*, 393, 129-142. doi: 10.1007/978-3-030-87495-7_9. Conference Paper.

Félix Orlando Martínez Ríos

Investigador Titular C, SNI Nivel I

A MULTIPROCESS SALP SWARM OPTIMIZATION WITH A HEURISTIC BASED ON CROSSING PARTIAL SOLUTIONS

ABSTRACT. The Salp swarm algorithm (SSA) is one of the most recent metaheuristic optimization algorithms. SSA has been used successfully to solve optimization problems in different research areas such as machine learning, engineering design, wireless networks, image processing, mobile robotics, and energy. In this article, we present a multi-threaded implementation of the SSA algorithm. Each thread executes an SSA algorithm that shares information among the swarms to get a better solution. The best partial solutions of each swarm intersect in a similar way of genetic algorithms. The experiments with nineteen benchmark functions (unimodal, multimodal, and composite) show the results obtained with this new algorithm are better than those achieved with the original algorithm. © 2021 Elsevier B.V.. All rights reserved.

Martinez-Rios, F. & Murillo-Suarez, A. (2021). A multi-process Salp swarm optimization with a heuristic based on crossing partial solutions. 5th International Conference on Computer Science and Computational Intelligence, ICCSCI 2020, virtual online. *Procedia Computer Science*, 179, 440-447. doi: 10.1016/j.procs.2021.01.027. Conference Paper.

Félix Orlando Martínez Ríos

Investigador Titular C, SNI Nivel I

MTGWA: A MULTITHREADED GRAY WOLF ALGORITHM WITH STRATEGIES BASED ON SIMULATED ANNEALING AND GENETIC ALGORITHMS

ABSTRACT. In this paper, we present an improvement of the Gray Wolf algorithm (GWO) based on a multi-threaded implementation of the original algorithm. The paper demonstrates how to combine the solutions obtained in each of the threads to achieve a final solution closer to the absolute minimum or even equal to it. To properly combine the solutions of each of the threads of execution, we use strategies based on simulated annealing and genetic algorithms. Also, we show the results obtained for twenty-nine functions: unimodal, multimodal, fixed dimension and composite functions. Experiments show that our proposed improves the results of the original algorithm. © 2021, ICST Institute for Computer Sciences, Social Informatics and Telecommunications Engineering.

Martinez-Rios, F., Murillo-Suarez, A., Garcia-Jacas, C. R., & Guerrero-Valadez, J. M. (2021). MTGWA: A Multi-threaded Gray Wolf Algorithm with Strategies Based on Simulated Annealing and Genetic Algorithms. 4th EAI International Conference on Computer Science and Health Engineering in Health Services, COMPSE 2020. *LNICST*, 359, 157-172. doi: 10.1007/978-3-030-69839-3_11. Conference Paper.

Félix Orlando Martínez Ríos

Investigador Titular C, SNI Nivel I

MULTI-THREADED SPOTTED HYENA OPTIMIZER WITH THREAD-CROSSING TECHNIQUES

ABSTRACT. This paper presents a Multi-threaded version of the Spotted Hyena Optimizer algorithm with thread-crossing techniques (MT-SHO) to improve the ability of the algorithm to explore the search space. The original algorithm is inspired by the hunting behavior of the spotted hyena. Along the different sections of the work, we explain in detail how the original algorithm simulates the spotted hyena's behavior to optimize highly complex mathematical functions and how we handle the procedures and results of the multi-threaded version, with thread-crossing techniques that improve the ability to explore and exploit the search space by letting threads learn between them. We present the experiments used to determine the best value of the parameters used in the parallel version of the algorithm and to prove that our proposal obtains significantly good results we compare the results obtained by evaluating 24 benchmark functions with the results published for the original algorithm as well as other metaheuristic algorithms. © 2021 Elsevier B.V.. All rights reserved.

Martinez-Rios, F. & Murillo-Suarez, A. (2021). Multi-threaded Spotted Hyena Optimizer with thread-crossing techniques. 5th International Conference on Computer Science and Computational Intelligence, ICCSCI 2020, virtual online. *Procedia Computer Science*, 179, 2021, 432-439. doi: 10.1016/j.procs.2021.01.026. Conference Paper.

Abraham Mendoza Andrade

Investigador Titular D, SNI Nivel I

Elías Olivares Benítez

Investigador Titular D, SNI Nivel I

INVENTORY REPLENISHMENT DECISIONS MODEL FOR THE SUPPLIER SELECTION PROBLEM FACING LOW PERFECT RATE SITUATIONS

ABSTRACT. This article addresses the supplier selection and order quantity allocation problem.

It introduces a model to minimize the total cost per time unit considering inventory and transportation costs. In selecting suppliers, two feasibility constraints are considered: capacity and perfect rate. The acceptable perfect rate of raw materials is ensured with a mathematical inequality in the model constraints. The proposed model addresses the desired perfect rate by including it as part of the order cycle parameters calculation and not as an individual constraint. Two main advantages of the proposed model are: (i) it leads to lower cost solutions compared to an existing model; and (ii) it effectively faces the low perfect rate situation, by providing feasible solutions when the perfect rate of suppliers is smaller than the minimum acceptable perfect rate required by the customer. A sensitivity analysis was carried out on the proposed model to analyze the effect of some parameters on the total cost per time unit. Results showed that transportation costs have an important effect on the order quantity and, also, that price levels do not necessarily affect the amount of purchased units. Hence the importance of considering transportation costs when making order quantity allocation decisions. © 2019, Springer-Verlag GmbH Germany, part of Springer Nature.

Alejo-Reyes, A., Mendoza, A. & Olivares-Benitez, E. (2021). Inventory replenishment decisions model for the supplier selection problem facing low perfect rate situations. *Optimization Letters*, 15(5), 1509-1535. doi: 10.1007/s11590-019-01510-0. Article.

Abraham Mendoza Andrade

Investigador Titular D, SNI Nivel I

Elías Olivares Benítez

Investigador Titular D, SNI Nivel I

MULTI-PERIOD MULTI-PRODUCT CLOSED LOOP SUPPLY CHAIN NETWORK DESIGN: A RELAXATION APPROACH

ABSTRACT. Growing concern about environmental deterioration, manifested in new laws to protect the environment and business competition, has stimulated the idea of Closed Loop Supply Chains (CLSC). This paper develops strategic decision-making models for two different CLSCs with multiple products over multiple periods. One of the networks has six levels, while the other has four levels, and they can be applied to products with different levels of complexity during inspection and remanufacturing operations. The supply chain networks are modeled as Integer Linear Programs (ILP) designed to assist decision-making in terms of location/allocation, transportation, and inventory. Taking advantage of the properties of the formulations, we propose an integer relaxation approach

to obtain the optimal solution to ILP. The proposed models and methodologies are illustrated with case studies from the literature and with hypothetical datasets. This research contributes with design standard configurations for CLSCs that can be used for different types of products. Directly using these configurations is advantageous because the models proposed can be quickly solved using the integer relaxation approach. The associated trials confirm the utility of the models for the case studies and demonstrate encouraging results for the hypothetical datasets. © 2021 Elsevier Ltd.

Pazhani S., Mendoza, A., Nambirajan, R., Narendran, T. T., Ganesh, K., & Olivares-Benitez, E. (2021). Multi-period multi-product closed loop supply chain network design: A relaxation approach. *Computers and Industrial Engineering*, 155. Art. 107191. doi: 10.1016/j.cie.2021.107191. Article.

Ernesto Moya Albor

Investigador Titular D, SNI Nivel I

Jorge Eduardo Brieva Rico

Investigador Titular D, SNI Nivel I

IMAGE ENCRYPTION AND DECRYPTION SYSTEM THROUGH A HYBRID APPROACH USING THE JIGSAW TRANSFORM AND LANGTON'S ANT APPLIED TO RETINAL FUNDUS IMAGES

ABSTRACT. In this work, a new medical image encryption/decryption algorithm was proposed. It is based on three main parts: the Jigsaw transform, Langton's ant, and a novel way to add deterministic noise. The Jigsaw transform was used to hide visual information effectively, whereas Langton's ant and the deterministic noise algorithm give a reliable and secure approach. As a case study, the proposal was applied to high-resolution retinal fundus images, where a zero mean square error was obtained between the original and decrypted image. The method performance has been proven through several testing methods, such as statistical analysis (histograms and correlation distributions), entropy computation, key-space assessment, robustness to differential attack, and key sensitivity analysis, showing in each one a high security level. In addition, the method was compared against other works showing a competitive performance and highlighting with a large key-space ($>1 \times 10^{11}$). Besides, the method has demonstrated adequate handling of high-resolution images, obtaining entropy values between 7.999988 and 7.999989, an average Number of Pixel Change Rate (NPCR) of $99.5796\% \pm 0.000674$, and a mean Uniform Average Change Intensity (UACI) of $33.4469\% \pm 0.00229$. In addition, when there is a small change in the key, the method does not give

additional information to decrypt the image. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

Romero-Arellano, A., Moya-Albor, E., Brieva, J., Cruz-Aceves, I., Avina-Cervantes, J. G., Hernandez-Gonzalez, M. A., & Lopez-Montero, L. M. (2021). Image encryption and decryption system through a hybrid approach using the jigsaw transform and langton's ant applied to retinal fundus images. *Axioms*, 10(3). Art. 215. doi: 10.3390/axioms10030215. Article.

Samuel Moisés Nucamendi Guillén

Investigador Titular D, SNI Nivel Candidato

Elías Olivares Benítez

Investigador Titular D, SNI Nivel I

Joel Novi Rodríguez Escoto

Profesor investigador

ANALYSIS OF THE HIRING COST IMPACT WITH A BI-OBJECTIVE MODEL FOR THE MULTI-DEPOT OPEN LOCATION ROUTING PROBLEM

ABSTRACT. This paper investigates the effect of the hiring cost over transportation cost and the capacity utilization for the vehicles used. This analysis is conducted on a multi-depot open location-routing problem. The problem consists of determining the optimal number of depots to open, as well as the design of the open routes in order to satisfy the demand for all of the customers while seeking the best trade-off between the total traveling and opening cost. To solve the problem, we propose a bi-objective mixed-integer linear model, which is solved using two different approaches: the augmented epsilon constraint 2 (AUGMECON2) method and the weighting revised multi-choice goal programming (WRMCGP) method. Both approaches are implemented, solving benchmark instances and comparing the quality of the Pareto fronts in terms of multi-objective metrics. Accordingly, the results indicate that AUGMECON2 performs better than WRMCGP concerning the quality of the Pareto Front and the elapsed CPU time, for instances with a homogeneous fleet. However, the WRMCGP reported the best solution time in the heterogeneous instances. In summary, considering heterogeneous fleets, the results demonstrate that the hiring cost can be reduced up to 85%, with 73% more vehicle utilization on average. Copyright © 2021 by SCITEPRESS - Science and Technology Publications, Ltd. All rights reserved.

Rodríguez-Escoto, J. N., Nucamendi-Guillén, S., & Olivares-Benitez, E. (2021). Analysis of the hiring cost impact with a Bi-objective model for the multi-depot open location routing problem. 10th International Conference on Operations Research and Enterprise Systems. *ICORES*, 2021, 425-432. Conference Paper.

Samuel Moisés Nucamendi Guillén

Investigador Titular D, SNI Nivel Candidato

LINKING LEAN ADOPTION AND IMPLEMENTATION IN HEALTHCARE TO NATIONAL CULTURES

ABSTRACT. Lean Healthcare (LHC) is a widely accepted approach to improve the quality of care around the world. This research compares two studies, which evaluated the adoption/implementation of LHC in Finland and Mexico, to understand how cultural similarities/differences influence LHC implementations. Data were gathered from previous questionnaire-based studies administered to healthcare professionals in both countries. Statistics (X2, p, and Wilcoxon tests) are used to compare both studies across topics related to adoption, introduction, integration, success, and barriers of LHC projects, and results are linked to cultural dimensions. Driven by economic savings, LHC has been more adopted in Finland than in Mexico (75/13%). Upon introduction, similarities are found in the way LHC projects are conducted, high project success rate, poor level of integration, and enabling/disabling factors. Conversely, differences were mainly found in the objectives of implementing LHC. These similarities/differences are linked to national factors involving culture, social structure, uncertainty management, time orientation, and indulgence level. In particular, uncertainty avoidance, equal rights' structure, and a feminine culture are positive for implementing Lean. These findings can be a benchmark to evaluate cultural practices. Thus, this study provides insight into how national cultures relate to LHC and determined distinctive sociotechnical aspects that influence its adoption/implementation. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

Peimbert-García, R. E., Jorma, T., Cárdenas-Barrón, L. E., Nucamendi-Guillén, S. M., & García-Reyes, H. (2021). Linking lean adoption and implementation in healthcare to national cultures. *Sustainability* (Switzerland), 13(16). Art. 8855. doi: 10.3390/su13168855. Article.

Samuel Moisés Nucamendi Guillén

Investigador Titular D, SNI Nivel Candidato

THE CUMULATIVE CAPACITATED VEHICLE ROUTING PROBLEM WITH PROFITS UNDER UNCERTAINTY

ABSTRACT. In this paper, we introduce the cumulative capacitated vehicle routing problem with profits and uncertain travel times. The aim is to visit a subset of customers maximizing the total collected revenue expressed as a decreasing function of the uncertain arrival times. The selective nature of the problem, the stochasticity of travel times, and the introduction of the capacity of vehicles make the problem

quite challenging. We present a risk-averse approach leading to a non-linear mixed integer mathematical model. To solve the model, we develop a very fast and efficient metaheuristic designed to address the selective nature of the problem. The performance of the metaheuristic is shown by preliminary results obtained for two sets of benchmark instances. © 2019, Springer Nature Switzerland AG.

Bruni, M. E., Nucamendi-Guillén, S., Khodaparasti, S., & Beraldi, P. (2019). The Cumulative Capacitated Vehicle Routing Problem with Profits Under Uncertainty. *AIRO Springer Series*, vol. 3, (pp. 311-322). Springer. doi: 10.1007/978-3-030-34960-8_28. Book Chapter.

Elías Olivares Benítez

Investigador Titular D, SNI Nivel I

Omar Guillermo Rojas Altamirano

Investigador Titular D, SNI Nivel I

FLEXIBLE SHIFT SCHEDULING FOR A CALL CENTRE USING COLUMN GENERATION

ABSTRACT. A shift scheduling problem for a call centre is solved by applying a column generation method. The objective is to find an employee schedule within the planning horizon that meets staffing requirements provided by the customer and that minimises the costs of excess-staffing and under-staffing. To solve the problem, two iterative models were used: The first being a mixed integer-linear programming model, the master problem, and the second being a column generation model. In a first approach, the master problem was solved considering a fixed number of shift patterns. The second approach was to use both models iteratively to generate shift patterns to be used in the master problem. Both approaches met all constraints relatively fast, but the column generation model decreased the cost considerably when cheaper shift patterns were generated. The models contribute to the current literature by providing flexibility to consider under-coverage and over-coverage at two levels. © 2021 Inderscience Enterprises Ltd. All rights reserved.

Amezcuca, C. C., Rojas, O. G., Gutierrez, E. Z., & Olivares-Benitez, E. (2021). Flexible shift scheduling for a call centre using column generation. *International Journal of Operational Research*, 40(4), 502-523. Conference Paper.

Elías Olivares Benítez

Investigador Titular D, SNI Nivel I

MULTI-OBJECTIVE DESIGN OF BALANCED SALES TERRITORIES WITH TABOO SEARCH: A PRACTICAL CASE

ABSTRACT. Sales territory design is an important research field because salesforce allocation within

territories impacts sales organization effectiveness and customer service. This work presents a novel multi-objective model for re-designing sales territories with three main objectives: sales balancing, workload balancing, and geographic balancing. To measure sales and workload balancing, the variance among territories was calculated. The metric considered for geographic balancing was the sum of the distances from every salesperson to their assigned customers. A metaheuristic algorithm based on Tabu search was developed to solve a weighted aggregate function that integrates the three objectives. The algorithm is embedded in a procedure to systematically change the weights in the aggregate objective function to produce an approximate Pareto front of solutions. The algorithm was tested with instances based on data from a company in Mexico, providing salesperson-customer assignments that can be projected in territories in geographic information systems. The algorithm converges very fast for the instances studied and produces a Pareto front efficiently. Comparing the current situation of the company to a dominating solution obtained with the algorithm in the Pareto front, a significant improvement in the balance is achieved, in the order of 42.0 - 47.1% on average in the three objective functions. Another managerial benefit achieved by the company was a better understanding for the top managers of the salesforce, the customer preferences, and the challenge of serving a large and dispersed market. © 2021 Kharazmi University. All rights reserved.

Olivares-Benitez, E., Bernábe-Loranca, M. B., Caballero-Morales, S. O., & Granillo-Macias, R. (2021). Multi-objective design of balanced sales territories with taboo search: A practical case. *International Journal of Supply and Operations Management*, 8(2), 176-193. doi:10.22034/IJSOM.2021.2.5. Article.

Francisco Alejandro Orozco Argote

SNI Nivel I

DEVELOPMENT OF COMMUNICATION PROTOCOLS BETWEEN BIM ELEMENTS AND 3D CONCRETE PRINTING

ABSTRACT. Historically, the construction industry has exhibited slow technological development when compared to other industries. However, during the last several years, investigations related to automation in construction have been conducted, such as additive manufacturing in concrete. This study aims to delve into this topic, providing effective communication between BIM-designed elements and its additive concrete manufacturing, with the help of an articulated robotic arm. Therefore, the paper addresses the preparation of computer code that allows such BIM-robot communication, checking

the parameters utilized, and analyzing the results of tests with the equipment involved. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

Forcael, E., Pérez, J., Vázquez, Á., García-Alvarado, R., Orozco, F., & Sepúlveda, J. (2021). Development of communication protocols between bim elements and 3D concrete printing. *Applied Sciences* (Switzerland), 11(16). Art. 7226. doi:10.3390/app11167226. Article.

Josué Ortiz Medina

SNI Nivel I

Claudia Nallely Sánchez Gómez

Investigadora Titular B, Profesora investigadora

Juan Bernardo Calabrese

Profesor investigador

CONVOLUTIONAL NEURAL NETWORKS FOR DETECTION OF HAND-WRITTEN DRAWINGS

ABSTRACT. Convolutional Neural Networks (CNN) have been used since the late 80's. Nevertheless, until the 2000's when they begun to be popular for image classification tasks, thanks to the improvements in computation performance of electronic devices and new algorithms development. However, most of the classifiers are oriented towards the processing of real-world images. This document presents a CNN for hand-written drawings recognition. The dataset consists of 710, 000 images that correspond to 71 different classes, each one with around 10, 000 samples. The dataset was randomly divided into a training set (80%) and a testing set (20%). The CNN classifier achieved an accuracy of 84.79% for classifying the samples on the testing set. The classification results showed perfect identification for 10 classes, whereas 6 classes were poorly classified. It is foreseen that the results presented here can fuel applications where identification of hand-made drawings are critical, such as neuropsychological tests. © 2020 IEEE.

Valenzuela, S. E., Calabrese, J. B., Ortiz-Medina, J., & Sanchez, C. N. (2020). Convolutional neural networks for detection of hand-written drawings. 2020 IEEE ANDESCON, ANDESCON 2020, Quito, Ecuador. *IEEE ANDESCON*, 2020. Art. 9272066. doi: 10.1109/ANDESCON50619.2020.9272066. Conference Paper.

Josué Ortiz Medina

SNI Nivel I

GRAPHENE OXIDE MEMBRANES FOR LACTOSE-FREE MILK

ABSTRACT. Because of the increasing demand for lactose-free milk, the dairy industry requires lactose separation membranes with effective anterior-

organic fouling. Here, we demonstrate that graphene oxide (GO) membranes exhibit higher lactose permeation flux (2.87 kg m⁻² day⁻¹) than commercial nanofiltration (0.57 kg m⁻² day⁻¹) and ultrafiltration (1.61 kg m⁻² day⁻¹) membranes, and display excellent water flux recovery (0.89) after milk filtration. Molecular dynamics (MD) simulations demonstrate that lactose exhibits mainly weak van der Waals interactions with GO layers, which allows lactose to diffuse through the nanochannels in GO membranes, whereas fat and proteins are preserved in milk. Fouling on membranes can be initiated via protein adsorption on the membrane surface, which diminishes the filtration performance. Hence, we performed MD calculations and experimental observations, which indicated that protein adsorption was dominated by Coulomb interactions. From milk filtration experiments, the fouling layers on GO membranes were porous, facilitating higher permeation flux and water flux recovery, whereas commercial nanofiltration and ultrafiltration membranes exhibited dense layers and lower water flux recovery. The unique lactose separation and water flux recovery of our novel GO membranes are ideal for food industry, wastewater treatment, medicine, and other related applications. © 2021 The Author(s).

Morelos-Gomez, A., Terashima, S., Yamanaka, A., Cruz-Silva, R., Ortiz-Medina, J., Sánchez-Salas, R., Fajardo-Díaz, J. L., Muñoz-Sandoval, E., López-Urías, F., Takeuchi, K., Tejima, S., Terrones M., & Endo, M. (2021). Graphene oxide membranes for lactose-free milk. *Carbon*, 181, 118-129. doi:10.1016/j.carbon.2021.05.005. Article.

Karina Ruby Pérez Daniel

Profesora investigadora

SIMILARITY LEARNING FOR CNN-BASED ASL ALPHABET RECOGNITION

ABSTRACT. Sign language is an important communication way to convey information among the deaf community, and it is primarily used by people who have hearing or speech impairments. Besides, sign language represents a direct Human-Computer-Interaction (HCI) similar to voice commands therefore, the purpose of this study is to investigate and develop a system for American Sign Language (ASL) alphabet recognition using convolutional neural networks. Our proposal is based on semantic similarity learning using Siamese Convolutional Neural Network to reduce the intra-class variation and inter-class similarity among sign images in a Euclidean space the results of the siamese architecture applied to the ASL alphabet dataset outperform previous works found in the literature. From these results, using t-SNE visualization, we demonstrate that our hypothesis is correct; the ASL rec-

ognition improves when increasing the similarity among encoding of the images belonging to the same class and reducing it otherwise. © 2021 The authors and IOS Press. All rights reserved.

Fierro Radilla, A. N., Perez Daniel, K. R., Benitez-Garcia, G., Najera Garcia, P., & Fuentes Valdez, R. (2021). Similarity learning for cnn-based asl alphabet recognition. 20th International Conference on New Trends in Intelligent Software Methodologies, Tools and Techniques, SoMet 2021, Cancun, Mexico. *Frontiers in Artificial Intelligence and Applications*, 337, 633-645. doi:10.3233/FAIA210060. Conference Paper.

Hiram Eredín Ponce Espinosa

Investigador Titular D, SNI Nivel I

Ricardo Abel Espinosa Loera

Profesor investigador

Josué Ortiz Medina

SNI Nivel I

A 3D ORTHOGONAL VISION-BASED BAND-GAP PREDICTION USING DEEP LEARNING: A PROOF OF CONCEPT

ABSTRACT. In this work, a vision-based system for the electronic band-gap prediction of organic molecules is proposed using a multichannel 2D convolutional neural network (CNN) and a 3D CNN, applied to the recognition and classification of 2D projected images from 3D molecular structure models. The generated images are input into the CNN for an estimation of the energy gap, associated with the molecular structure. The public data set used in this research was the Organic Materials Database (OMDB-GAP1). A data transformation from the descriptive information contained in the data set to three 2D orthogonal images of molecules was done. The training set is composed of 30,000 images, whereas the testing set was composed of 7500 images, from 12,500 different molecules. The multichannel 2D CNN architecture was optimized via Bayesian optimization. Experimental results showed that the proposed CNN model obtained an acceptable mean absolute error of 0.6780 eV and root mean-squared error of 0.7673 eV, in contrast to two machine learning methods reported in the literature used for band-gap prediction based on conventional density function theory (DFT) methods. These results demonstrate the feasibility of CNN models to materials science routines using orthogonal images projections of molecules. © 2021 Elsevier B.V.

Espinosa, R., Ponce, H., & Ortiz-Medina, J. (2022). A 3D orthogonal vision-based band-gap prediction using deep learning: A proof of concept. *Computational Materials Science*, 202. Art. 110967. doi:10.1016/j.comatsci.2021.110967. Article.

Hiram Eredín Ponce Espinosa
Investigador Titular D, SNI Nivel I

A MACHINE LEARNING APPROACH FOR MODELING SAFETY STOCK OPTIMIZATION EQUATION IN THE COSMETICS AND BEAUTY INDUSTRY

ABSTRACT. Safety Stock is generally accepted as an appropriate inventory management strategy to deal with the uncertainty of demand and supply, as well as for limiting the risk of service loss and overproduction. In particular, companies from the cosmetics and beauty industry face additional inventory management challenges derived from the strict regulatory standards applicable in different jurisdictions, in addition to the constantly changing trends, which highlight the importance of defining an accurate safety stock. In this paper, on the basis of the Linear Regression, Decision Trees, Support Vector Machine ("SVM") and Neural Network machine learning techniques, we modeled a general Safety Stock equation and one per product category for a multinational enterprise operating in the cosmetics and beauty industry. The results of our analysis indicate that the Linear Regression is the most accurate model to generate a reasonable and effective prediction of the company's Safety Stock. © 2021, Springer Nature Switzerland AG.

Díaz, D., Marta, R., Ortega, G., & Ponce, H. (2021). A Machine Learning Approach for Modeling Safety Stock Optimization Equation in the Cosmetics and Beauty Industry. 20th Mexican International Conference on Artificial Intelligence, MICAI 2021, Mexico City, Mexico. *LNAI*, 13067, 173-186. doi: 10.1007/978-3-030-89817-5_13. Conference Paper.

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Investigador Titular D, SNI Nivel I

Ricardo Abel Espinosa Loera
Profesor investigador

AN INTELLIGENT WATER CONSUMPTION PREDICTION SYSTEM BASED ON INTERNET OF THINGS

ABSTRACT. This work presents the development of a measurement system for water consumption based on the Internet of Things concept. In this paper, we propose a supervised learning method namely artificial hydrocarbon networks (AHN) to predict water consumption one hour ahead. A Hall effect sensor was used to obtain the water flow value through an embedded system and to show it in an interface developed in Visual Studio. For that, the embedded system sent the data in real time to a database in Firebase using the JSON communication protocol. There, the consumed water

flow is stored periodically. Experimental results of the supervised learning model conclude that AHN model predicts the conditions for efficient consumption with an average root-mean squared error of 2.4924 liters per hour. © 2020 IEEE.

Gutiérrez, S., Ponce, H., & Espinosa, R. (2020). An Intelligent Water Consumption Prediction System based on Internet of Things. 2020 IEEE International Conference on Engineering Veracruz. *ICEV*, 2020. Art. 9289683. doi: 10.1109/ICEV50249.2020.9289683. Conference Paper.

Hiram Eredín Ponce Espinosa
Investigador Titular D, SNI Nivel I

María de Lourdes Martínez Villaseñor
SNI Nivel I

ARTIFICIAL HYDROCARBON NETWORKS FOR FREEZING OF GAIT DETECTION IN PARKINSON'S DISEASE

ABSTRACT. Freezing of gait (FoG) is one of the most impairing phenomenon experienced by Parkinson's disease (PD) patients. This phenomenon is associated with falls and is an important factor that limits autonomy and impairs quality of life of PD patients. Pharmacological treatment is difficult and do not always help to deal with this problem. Robust FoG detection systems can help monitoring and identifying when a patient needs aid providing external cueing to deal with FoG episodes. In this paper, we describe a comparative analysis of traditional machine learning techniques against Artificial Hydrocarbon Networks (AHN) for FoG detection. We compared four supervised machine learning classifiers and AHN for FoG event detection using a publicly available dataset, obtaining 88% of F-score metric with AHN. We prove that AHN are suitable for FoG detection. © 2020 IEEE.

Martínez-Villaseñor, L., Ponce, H., & Núñez-Martínez, J. (2020). Artificial Hydrocarbon Networks for Freezing of Gait Detection in Parkinson's Disease. 2020 International Conference on Mechatronics, Electronics and Automotive Engineering, Cuernavaca, Morelos. *ICMAE*, 2020, 3-8. Art. 9359398. doi: 10.1109/ICMAE51770.2020.00008. Conference Paper.

Hiram Eredín Ponce Espinosa
Investigador Titular D, SNI Nivel I

GEOLOCATION SYSTEM OF FIRE MONITORING STATION THROUGH LORAWAN

ABSTRACT. The evolution of the Internet of Things (IoT) over the last few years has a growing outcome, where LoRaWAN™ based solutions have a remarkable increase in its quality and innovation.

This evolution is pushing the integration of new capabilities, such as real-time responsiveness, resilient systems, massive management of devices, geolocation, tracking, and smarter notification systems. The current work presents a design and an implementation proposal of a LoRaWAN™ solution to monitor the probability of existing fire in a given location. This application is capable of integrating the above-mentioned features by exploiting the benefits of LoRaWAN™ protocol and its capability to interact with cloud services. The system makes use of The Thing Network (TTN) as LoRa™ Network Server (LNS), LoRa™ cloud Geolocation Services for tracking, Amazon Web Service Elastic Cloud Computing (AWS EC2) as a container of the application, and advanced features of Go programming language for the rest of features such as notifications, dashboards and data operations as extraction, transformation and load (ETL). ©2006-2021 Asian Research Publishing Network (ARPN). All rights reserved.

Luna, P., Gutiérrez, S., & Ponce, H. (2021). Geolocation system of fire monitoring station through Lorawan. *ARPN Journal of Engineering and Applied Sciences*, 16(7), 790-795. Article.

Hiram Eredín Ponce Espinosa
Investigador Titular D, SNI Nivel I

Ricardo Abel Espinosa Loera
Profesor investigador

INTELLIGENT MANAGEMENT SYSTEM FOR MICRO-GRIDS USING INTERNET-OF-THINGS

ABSTRACT. The current research work proposes the design of an intelligent platform for managing the generation, distribution, transmission, commercialization and consumption of electricity, allowing the decision-making process aimed at reducing costs and maximizing the use of energy resources. The technological proposal is a system of information made of integrated sensors. This creates an electrical real-time network that share energy in the cloud through LPWAN networks. Later, the data from the sensors are received in an intelligent platform (Max4 IoT) that employs super-computing systems and artificial intelligence for the analysis of individual and aggregated data. The system is able to learn about the electrical network, knowing the consumers' behavior and energy trends, allowing to generate responses based on specific situations by sending SMS alerts and emails about abnormal situations or programmed tasks. In addition, the system allows the generation of reports on the network status in real-time and commands control signals on the switching on-and-off of equipment in response to consumption peaks and/or power supply outages. The platform allows interaction with distributed generation

systems and micro-grids, through its mobile or web interface, increasing user interaction with the electrical system and the inclusion of renewable energy sources, thus influencing a better quality of service provided to the end user. © 2021 IEEE.

Gutiérrez, S., Medina, G., Ponce, H., & Espinosa, R. (2021). Intelligent management system for micro-grids using internet-of-things. 3rd Mexican Humanitarian Technology Conference, virtual online, Puebla, México. *MHTC*, 2021, 13-18. Art. 9419921. doi: 10.1109/MHTC52069.2021.9419921. Conference Paper.

Hiram Eredín Ponce Espinosa
Investigador Titular D, SNI Nivel I

MECHATRONICS TEACHING THROUGH VIRTUAL PLATFORMS FOR HOME CONFINEMENT DUE TO COVID-19

ABSTRACT. The pandemic that has been unleashed all over the world has forced us to change our way of life, this includes to avoid face-to-face classes. Therefore, an important question arises: how to carry out the online classes of a subject in which the main focus is on developing projects such as the Mechatronics course? This document presents the platforms used in the online course that include: Factory I/O, Overleaf, Tinkercad and FluidSIM, for replacing face-to-face practices. The course development, its characteristics and even the practices that have been done during the online course on the platforms are explained. The main idea is to show that it is possible to substitute the face-to-face practices, using appropriate online tools for each topic within the course. The use of online platforms and simulation software allows obtaining new skills of teaching regarding laboratory subjects. In general, online platforms allow having an alternative and new tools to transform the most of the course to the online mode. © 2020 IEEE.

Delgado, L. D. R., Alvarez, S. D. M., Gutiérrez, S., & Ponce, H. (2020). Mechatronics Teaching through Virtual Platforms for Home Confinement due to COVID-19. Proceedings-2020 International Conference on Mechatronics, Electronics and Automotive Engineering, Cuernavaca, Morelos. *ICMAE*, 2020, 180-185. Art. 9359431. doi: 10.1109/ICMAE51770.2020.00038. Conference Paper.

Hiram Eredín Ponce Espinosa
Investigador Titular D, SNI Nivel I

MEXICAN AUTOMOTIVE INDUSTRY SALES BEHAVIOR DURING THE COVID-19 PANDEMIC

ABSTRACT. This work shows the results of forecasting the behavior of sales in the Mexican auto-

motive industry in a simulated scenario without COVID-19 and comparing it with the actual sales numbers. As this pandemic has caused traditional forecasting techniques to show poor performance and low prediction quality, this work aims to estimate the number of sales lost during the pandemic, using a machine learning model based on several explanatory variables and predicting those variables without the influence of the COVID-19 pandemic. Three different regression models were tested (Linear regression, Random Forest and Neural Network) creating scenarios and incorporating different variables into the models. Random Forest with 3 variables shows the highest predictive power. This model applied on forecast variables without pandemic's impact predicts 1,342,028 units sold between February 2020 and January 2021, representing a 29.76% drop in sales and a total impact of 416,324 sales lost due to the pandemic. © 2021, Springer Nature Switzerland AG.

Ramírez, J., Alarcón, J., Calzada, G., & Ponce, H. (2021). Mexican Automotive Industry Sales Behavior During the COVID-19 Pandemic. 20th Mexican International Conference on Artificial Intelligence, MICAI 2021, Mexico City, Mexico. *LNAI*, 13068, 265-276. doi: 10.1007/978-3-030-89820-5_22. Conference Paper.

Hiram Eredín Ponce Espinosa

Investigador Titular D, SNI Nivel I

Edgar Avalos Gauna

Profesor investigador

SENTIMENT ANALYSIS ON TWITTER ABOUT COVID-19 VACCINATION IN MEXICO

ABSTRACT. This paper conducts a sentiment analysis of Twitter's posts, between late October 2020 and late April 2021, regarding COVID-19 vaccination campaign in Mexico through several machine learning models such as Logistic Regression, Neuronal Network, Naive Bayes and Support Vector Machine. To prepare data, Natural Language Processing techniques were used such as tokenization, stemming, n-grams and stopwords. The best performance was achieved by Logistic Regression with an accuracy score of 83.42% while classifying tweets according to a positive or negative sense. This work suggests that sentiment analysis with Twitter information allows to witness a relevant part of the public discussion around specific topics. For this study, the tweets analyzed showed a similar behavior to other search and reference electronic tools, such as Google Trends regarding conversation around COVID. In addition, the present analysis allows the classification and tendency of public opinion. Furthermore, this study shows that measuring people's opinion through machine learning

and natural language processing techniques can generate significant benefits for institutions and businesses given that obtaining information on Twitter is less expensive and can be processed and analyzed faster than other opinion analysis techniques such as surveys or focus groups. © 2021, Springer Nature Switzerland AG.

Bernal, C., Bernal, M., Noguera, A., Ponce, H., & Avalos-Gauna, E. (2021). Sentiment Analysis on Twitter About COVID-19 Vaccination in Mexico. 20th Mexican International Conference on Artificial Intelligence, MICAI 2021, Mexico City, Mexico. *LNAI*, 13068, 96-107. doi: 10.1007/978-3-030-89820-5_8. Conference Paper.

Julio César Rosas Caro

SNI Nivel I

Héctor Rogelio Robles Campos

Profesor investigador

OPTIMAL OPERATION OF THE VOLTAGE-DOUBLER BOOST CONVERTER THROUGH AN EVOLUTIONARY ALGORITHM

ABSTRACT. This manuscript presents the numerical optimization (through a mathematical model and an evolutionary algorithm) of the voltage-doubler boost converter, also called the series-capacitor boost converter. The circuit is driven by two transistors, each of them activated according to a switching signal. In the former operation, switching signals have an algebraic dependence from each other. This article proposes a new method to operate the converter. The proposed process reduces the input current ripple without changing any converter model parameter, only the driving signals. In the proposed operation, switching signals of transistors are independent of each other, providing an extra degree of freedom, but on the other hand, this produces an infinite number of possible combinations of duty cycles (the main parameter of switching signals) to achieve the desired voltage gain. In other words, this leads to a problem with infinite possible solutions. The proposed method utilizes an evolutionary algorithm to determine the switching functions and, at the same time, to minimize the input current ripple of the converter. A comparison made between the former and the proposed operation shows that the proposed process achieves a lower input current ripple while achieving the desired voltage gain. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

Rodriguez, A., Alejo-Reyes, A., Cuevas, E., Ramirez, J. M., Rosas-Caro, J. C., & Robles-Campos, H. R. (2021). Optimal Operation of the Voltage-Doubler Boost Converter through an Evolutionary Algorithm. *Mathematics*, 9(4). Art. 423. doi: 10.3390/math9040423. Article.

Rodrigo Romero Silva

SNI Nivel I

LEARNING FROM THE PAST TO SHAPE THE FUTURE: A COMPREHENSIVE TEXT MINING ANALYSIS OF OR/MS REVIEWS

ABSTRACT. This paper provides an overview of the evolution and state-of-the-art of the Operations Research and Management Science (OR/MS) subject area from 1956 to 2019. Using text mining techniques on the content of the title, abstract, and author keywords of papers classified by the Web of Science as literature review studies in OR/MS, we found that there are 76 topical consolidated clusters in the field covering a wide range of reviewed topics. Since 2015, reviews on supply chain risk management and big data analytics have had the highest impact in the field, whereas topics such as Industry 4.0, socio-technical systems, social networks, green supply, sustainable supply chain, and resilience engineering have all received significant attention from researchers. Reviews on analytic hierarchy process were found to be the most impactful overall, showing the high relevance of multi-criteria decision making in the current research and practice contexts. Furthermore, a text mining analysis of the papers citing OR/MS literature reviews showed that optimization continues to be one of the most highly influential methodological contributions of OR/MS to other research areas and that topics such as circular economy, carbon emissions, and social commerce have yet to find some traction in OR/MS research, suggesting future research and multidisciplinary opportunities for the field. Results also show that the research area of Public Administration has been greatly influenced by OR/MS reviews as 16% of all the papers published in that field have cited at least one of the 1744 review papers included in this study. Finally, a summary table of published structured literature reviews per topic (benchmarks, classifications, taxonomies) is presented as a short bibliography of OR/MS review papers. © 2020

Romero-Silva, R., & de Leeuw, S. (2021). Learning from the past to shape the future: A comprehensive text mining analysis of OR/MS reviews. *Omega* (United Kingdom), 100. Art. 102388. doi: 10.1016/j.omega.2020.102388. Article.

Rodrigo Romero Silva

SNI Nivel I

MAPPING OPERATIONS RESEARCH IN PROJECT MANAGEMENT: A BIBLIOMETRIC ANALYSIS

ABSTRACT. Successful project management can help organisations in reducing costs and increasing its efficiency. Likewise, operations research has

contributed significantly to improve project management performance with phase-project-planning methodologies. However, as far as we know, there is no literature review that compiles operations research in project management (OR+PM). Thus, this paper aims to present a bibliometric analysis of OR+PM using 1,254 research papers retrieved from ISI Web of Science. This final dataset is composed of articles from scientific journals published between 2001-2018. The results indicate that project scheduling, project management and resource-constrained project scheduling have been the backbone concepts of OR+PM; while terms, such as sustainability, earned value management, multi-objective optimisation, and multi-mode resource-constrained project scheduling problem have been gaining relevance in recent years. Results also show who have been the most influential authors, institutions and countries in the development of this field. Finally, future research opportunities for OR+PM are identified. Copyright © 2021 Inderscience Enterprises Ltd.

Muñoz-Villamizar, A., Solano-Charris, E. L., & Romero-Silva, R. (2021). Mapping operations research in project management: A bibliometric analysis. *International Journal of Logistics Systems and Management*, 39(1), 52-76. doi: 10.1504/IJLSM.2021.115079. Article.

Rodrigo Romero Silva

SNI Nivel I

PERFORMANCE OF MERGING LINES WITH UNEVEN BUFFER CAPACITY ALLOCATION: THE EFFECTS OF UNRELIABILITY UNDER DIFFERENT INVENTORY-RELATED COSTS

ABSTRACT. This simulation study investigates whether machine efficiency, mean time to failure (MTTF) and mean time to repair (MTTR) significantly affect the performance of uneven buffer capacity allocation patterns for merging lines. Also studied is the trade-off between increasing throughput via bigger buffers and their associated inventory-related costs, since previous studies have shown that higher overall buffer capacity and higher average inventory content result in higher throughput. Results suggest that an ascending buffer allocation pattern (concentrating buffer capacity towards the end of the line) produces higher throughput in shorter, more unreliable lines; whereas the balanced pattern shows better performance in longer, more reliable lines. Increasing average buffer capacity per station and/or having higher average buffer content was found to be more cost-effective in lines with lower machine inefficiency, shorter MTTF and MTTR,

and longer lines. Results differed between reliable and unreliable lines since reliable lines were particularly penalised by buffer capacity investment/maintenance costs due to a relatively low increase in throughput resulting from the addition of extra buffer capacity. © 2020, The Author(s).

Shaaban, S. & Romero-Silva, R. (2020). Performance of merging lines with uneven buffer capacity allocation: the effects of unreliability under different inventory-related costs. *Central European Journal of Operations Research*, 29(3), 1253-1288. doi: 10.1007/s10100-019-00670-9. Article.

Rodrigo Romero Silva

SNI Nivel I

THE IMPACT OF UNEQUAL PROCESSING TIME VARIABILITY ON RELIABLE AND UNRELIABLE MERGING LINE PERFORMANCE

ABSTRACT. Research on merging lines is expanding as their use grows significantly in the contexts of remanufacturing, reverse logistics and developing economies. This article is the first to study the behavior of unpaced, reliable, and unreliable merging assembly lines that are deliberately unbalanced with respect to their coefficients of variation (CV). Conducting a series of simulation runs with varying line lengths, buffer storage capacities and unbalanced CV patterns delivers intriguing results. For both reliable and unreliable lines, the best pattern for generating higher throughput is found to be a balanced configuration (equal CVs along both parallel lines), except for unreliable lines with a station buffer capacity of six. In that case, the highest throughput results from the descending configuration, i.e. concentrating the variable stations close to the beginning of both parallel lines and the steady stations towards the end of the line. Ordering from the least to most steady station also provides the best average buffer level. By exploring the experimental Pareto Frontier, this study shows the combined performance of unbalanced CV patterns for throughput and average buffer level. Study results suggest that caution should be exercised when assuming equivalent behavior from reliable and unreliable lines, or single serial lines and merging lines, since the relative throughput performance of some CV patterns changed between the different configurations. © 2021

Romero-Silva, R., Shaaban, S., Marsillac, E., & Laarraf, Z. (2021). The impact of unequal processing time variability on reliable and unreliable merging line performance. *International Journal of Production Economics*, 235. Art. 108108. doi: 10.1016/j.ijpe.2021.108108. Article.

Luis Alberto Rosa Sierra

SNI Nivel II

Fabiola Cortés Chávez

Profesora investigadora

ANALYSIS OF THE IMPACT ON MEXICAN CONSUMERS OF THE NEW PRECAUTIONARY LEGENDS IN PROCESSED FOODS WITH EXCESS NUTRIMENTS

ABSTRACT. In Mexico, processed foods usually contain critical nutrients and ingredients that represent a risk to consumer health, which is why, on October 1, 2020, modifications were made to the Official Mexican Standard NOM-051-SCFI/SSA1-20101, which aims to provide the final consumer with commercial and health information on caffeine content, excess saturated fat, sodium, sugars, calories and/or use of sweeteners. The objective of this research is to determine the deterrent effect on consumption that the new precautionary legends established by this standard may have in prepackaged foods that have excess sugar, fats, transgenic fats, sodium and/or calories in young Mexican consumers between 19 and 31 years old. Likewise, it will be analyzed whether the knowledge of the presence of these critical nutrients in processed foods will have any influence on their future consumption habits of this type of food. © 2021, The Author(s), under exclusive license to Springer Nature Switzerland AG.

García-Hernández, M., Cortés-Chavez, F., Marín-Alvarez, M., Rossa-Sierra, A., González-Muñoz, E. L., & Rivero-Orozco, B. D. (2021). Analysis of the Impact on Mexican Consumers of the New Precautionary Legends in Processed Foods with Excess Nutrients. *AHFE Conferences on Creativity, Innovation and Entrepreneurship, and Human Factors in Communication of Design*, 2021, virtual online. *Lecture Notes in Networks and Systems*, 276, 580-587. doi: 10.1007/978-3-030-80094-9_70. Conference Paper.

Luis Alberto Rosa Sierra

SNI Nivel II

Fabiola Cortés Chávez

Profesora investigadora

IMPLANTABLE MEDICAL DEVICE FOR DEPRESSION: BE CLEAR

ABSTRACT. Depression is often said to result from a chemical imbalance, but that speech figure does not capture how complicated this disease is. Researchers have learned much about the biology of depression, identifying genes that make individuals more vulnerable to low moods and influ-

ence how they respond to drug therapy. Even though there are several ways to treat it, electroconvulsive therapy (Brain Stimulation) remains one of the most effective treatments. Through neuromodulation, the brain is stimulated to produce a natural biological response; with this, it is sought to stimulate the brain's area closely associated with depression. Therefore, this paper shows advances in designing an implantable medical device platform using the biocompatible shape memory material nitinol, applying endovascular neurosurgery to treat depression. This method involves mild pulses at programmed time intervals applied to the nucleus accumbens to achieve an antidepressant effect via a cardiac delivery pacemaker with an internal diameter of less than 1.3 mm through the jugular vein by harvesting the natural energy of a heartbeat without an external battery. © 2021, The Author(s), under exclusive license to Springer Nature Switzerland AG.

Rivero-Orozco, B., Navarro-Valadez, A., Olivares-Sandoval, S., Rossa-Sierra, A., & Cortés-Chavez, F. (2021). Implantable Medical Device for Depression: Be Clear. *AHFE Conference on Human Factors and Ergonomics in Healthcare and Medical Devices*, 2021, virtual online. *Lecture Notes in Networks and Systems*, 263, 239-244. doi: 10.1007/978-3-030-80744-3_30. Conference Paper.

Luis Alberto Rosa Sierra

SNI Nivel II

Fabiola Cortés Chávez

Profesora investigadora

IMPROVING THE EXPERIENCE OF HEMOTHERAPY TREATMENT FOR KIDS WITH LEUKEMIA

ABSTRACT. When analyzing the significant stressors on children, nurses, and the tutor of the patient during their chemotherapy treatment, studies showed medical procedures, such as needles and nasogastric tubes, loss of control, hospital environment, relapses, and fear of death as the principal stressors that affect the well-being of children with cancer. As a result of this research, a system was designed that improved the infant's experience and that of his/her companion. They focus on enhancing the experience before, during, and after chemotherapy treatment, providing a positive user experience through techniques and user-centered design. The methodology used in the development is based on the Double Diamond method, which allows discovering and defining the problem to obtain the development before the potential solution to the problem. The results were verified based on pilot tests of children with leukemia in colonies

of scarce resources in Guadalajara, Mexico. © 2021, The Author(s), under exclusive license to Springer Nature Switzerland AG.

Brun-Virues, M., García-Manzano, M., Rentería-González, M., Durán-Aguilar, G., Cortés-Chavez, F., & Rossa-Sierra, A. (2021). Improving the Experience of Hemotherapy Treatment for Kids with Leukemia. *AHFE Conferences on Usability and User Experience, Human Factors and Wearable Technologies, Human Factors in Virtual Environments and Game Design, and Human Factors and Assistive Technology*, 2021, virtual online. *Lecture Notes in Networks and Systems*, 275, 1099-1106. doi: 10.1007/978-3-030-80091-8_130. Conference Paper.

Luis Alberto Rosa Sierra

SNI Nivel II

Fabiola Cortés Chávez

Profesora investigadora

REHAB: NEW WAYS TO IMPROVE PHYSIOTHERAPY REHABILITATION EXPERIENCE

ABSTRACT. The paper describes detailed data observation for the analysis and comprehension of the actual barriers and improvements that already exist in the world of physiotherapy rehabilitation and how, with the use of applied technologies as (UI) user interface, series of screens, pages, and visual elements, (UX) design process whose sole objective is to design a system that offers a great experience to its users, (AR) Augmented reality is a technology that works on computer vision based recognition algorithms to augment sound, video, graphics, and other sensor-based inputs on real-world objects using the camera of your device, and (LIDAR) stands for Light Detection and Ranging, is a remote sensing method that uses light in the form of a pulsed laser to measure ranges. All of them embedded in a mobile application and camera companion can improve the whole process's experience and results, from an injury to full rehabilitation, benefiting both sides, physiotherapists and patients. © 2021, The Author(s), under exclusive license to Springer Nature Switzerland AG.

García-García, F. E., Boccherini-Gallardo, M., Rossa-Sierra, A., & Cortés-Chavez, F. (2021). Rehab: New Ways to Improve Physiotherapy Rehabilitation Experience. *AHFE Conferences on Usability and User Experience, Human Factors and Wearable Technologies, Human Factors in Virtual Environments and Game Design, and Human Factors and Assistive Technology*, 2021, virtual online. *Lecture Notes in Networks and Systems*, 275, 1134-1143. doi: 10.1007/978-3-030-80091-8_135. Conference Paper.

Luis Alberto Rosa Sierra

SNI Nivel II

Fabiola Cortés Chávez

Profesora investigadora

THE DESIGN OF A USER CENTERED QUICK DIABETES TESTING AS A POSSIBLE SOLUTION FOR LATE DIAGNOSIS COMPLICATIONS IN REMOTE COMMUNITIES

ABSTRACT. In this paper it has been tried to proof that by the design of a user centered quick diabetes urine detector, the number of potentially risked number of diabetes patients could be considerably reduce, first by showing the need for new solutions for the diabetes detection problem in Mexico and exposing the current statistics, then a hypothesis to contribute to the solution of this problem was made, which in this case was the fabrication of the previous described urine detector. After research a design was made and tested in 25 users to see its usability and other ergonomic variables to be considered. The results contribute to the improvement of the final design; and allow it to have that great usability which was searched. The paper ends by the conclusion emphasizing how diabetes patients could be potentially helped by the commercialization of the proved device. © 2021, The Author(s), under exclusive license to Springer Nature Switzerland AG.

Garciarce-Nechyba, J. P., Castellanos-Gonzalez, G. M., Aguilera-Gonzalez, M. J., Rossa-Sierra, A., & Cortes-Chavez, F. (2021). The Design of a User Centered Quick Diabetes Testing as a Possible Solution for Late Diagnosis Complications in Remote Communities. AHFE Conference on Human Factors and Ergonomics in Healthcare and Medical Devices, 2021, virtual online. *Lecture Notes in Networks and Systems*, 263, 191-196. doi: 10.1007/978-3-030-80744-3_24. Conference Paper.

Julio César Rosas Caro

SNI Nivel I

Antonio Valderrábano González

SNI Nivel I

A DYNAMIC MOTION TRACKING CONTROL APPROACH FOR A QUADROTOR AERIAL MECHANICAL SYSTEM

ABSTRACT. This paper deals with the reference trajectory tracking problem and simultaneous active disturbance suppression on a class of controlled aerial mechanical systems by processing measurable output signals. A novel dynamic control method for desired motion reference trajectory tracking for quadrotor helicopters is introduced. Measurements of position output signals for

efficient and robust tracking of motion profiles specified for the unmanned aerial vehicle are only required. Thus, differentiation of signals and real-time estimation of disturbances affecting the multi-input multioutput, underactuated nonlinear dynamic system are unnecessary. The presented active control approach can be directly extended for a class of vibrating mechanical systems. Analytical, experimental, and numerical results are presented to prove the satisfactory performance of the proposed trajectory tracking control approach for considerably perturbed operating scenarios. © 2020 Hugo Yañez-Badillo et al.

Yañez-Badillo, H., Beltran-Carbajal, F., Tapia-Olvera, R., Valderrabano-Gonzalez, A., Favela-Contreras, A., & Rosas-Caro, J. C. (2020). A Dynamic Motion Tracking Control Approach for a Quadrotor Aerial Mechanical System. *Shock and Vibration*, 2020. Art. 6635011. doi: 10.1155/2020/6635011. Article.

Julio César Rosas Caro

SNI Nivel I

Carolina del Valle Soto

Investigadora Titular D, SNI Nivel I

ANALYSIS OF THE INPUT CURRENT-RIPPLE IN THE SERIES-CAPACITOR BOOST CONVERTER

ABSTRACT. This letter presents an analysis along with a design method and pulsewidth modulation operation for the series-capacitor boost converter, which reduces the input current ripple without increasing the stored energy in inductors, that is, without increasing their physical size. The method can also be applied to the buck version of the converter. Experimental results are provided to evaluate the performance of the proposed approach. © 1982-2012 IEEE.

Rosas-Caro, J. C., Escobar, G., Valdez-Resendiz, J. E., Mayo-Maldonado, J. C., Beltran-Carbajal, F., & Del-Valle-Soto, C. (2021). Analysis of the Input Current-Ripple in the Series-Capacitor Boost Converter. *IEEE Transactions on Industrial Electronics*, 68(10), 10303-10308. Art. 9209078. doi: 10.1109/TIE.2020.3026304. Article.

Julio César Rosas Caro

SNI Nivel I

Antonio Valderrábano González

SNI Nivel I

CLOSED-LOOP ONLINE HARMONIC VIBRATION ESTIMATION IN DC ELECTRIC MOTOR SYSTEMS

ABSTRACT. In this article, an active vibration control technique for direct-current electric motors sub-

jected to harmonic mechanical load torque is introduced. Formulae to compute uncertain parameters of amplitude, frequency and phase angle of harmonic torque disturbances for angular velocity reference trajectory tracking are proposed. Vibrating torque disturbances are actively suppressed by the control voltage input. Mathematical modelling based on vibrating systems is adopted for purposes of online parameter estimation of oscillating signals. In this fashion, accurate estimation can be performed using measurements of the output signal only. Online parameter estimation is extended for a class of controllable dynamical engineering systems subjected to harmonic disturbances. Formulae for closed-loop online parameter estimation of harmonic vibrations on differentially flat linear dynamical systems of n degrees of freedom for efficient tracking of desired time-varying motion reference profiles are then presented. Analytical and numerical results prove that proposed formulae can be used to accurately determine the parameters of unknown harmonic vibrations, which is an excellent feature for high-efficiency active vibration control strategies. © 2021 Elsevier Inc.

Beltran-Carbajal, F., Tapia-Olvera, R., Valderrabano-Gonzalez, A., Yanez-Badillo, H., Rosas-Caro, J. C., & Mayo-Maldonado, J. C. (2021). Closed-loop online harmonic vibration estimation in DC electric motor systems. *Applied Mathematical Modelling*, 94, 460-481. doi: 10.1016/j.apm.2021.01.021. Article.

Julio César Rosas Caro

SNI Nivel I

DETAILED MODELING OF THE LOW ENERGY STORAGE QUADRATIC BOOST CONVERTER

ABSTRACT. The low energy storage quadratic boost converter (LES-QBC) was recently proposed as an advantageous topology in terms of reduced output voltage ripple and fast dynamic response, besides high power density and reduced energy storage. The topological configuration can be exploited mainly through a 180° phase shift between the controlled switch gate signals. Nevertheless, this feature imposes a relevant challenge in terms of modeling, since traditional averaging an ripple estimation techniques cannot provide an accurate approximation to the actual switching dynamics of the converter. Motivated by this issue, in this article, we provide a complete quantitative analysis of both the steady-state and dynamic behavior of the LES-QBC, giving a fine understanding of their operation in continuous conduction mode when a pulse width modulator is used. The voltage gain, ripple factor, and dynamic behavior are modeled considering parasitic resistances and a

wide operation range for the input voltage and the load. The demonstrated performance corroborates the high value of the converter for several applications in the industry. Every theoretical prediction is fully validated via simulations and experimental results. © 1986-2012 IEEE.

Lopez-Santos, O., Varon, N. L., Rosas-Caro, J. C., Mayo-Maldonado, J. C., & Valdez-Resendiz, J. E. (2022). Detailed Modeling of the Low Energy Storage Quadratic Boost Converter. *IEEE Transactions on Power Electronics*, 37(2), 1885-1904. doi: 10.1109/TPEL.2021.3105081. Article.

Julio César Rosas Caro

SNI Nivel I

DIFFERENTIAL AND COMMON-MODE MODEL-BASED CONTROLLER FOR THE DOUBLE-DUAL BUCK TRANSFORMERLESS INVERTER

ABSTRACT. This paper studies the double-dual DC-DC buck converter composed by two buck power stages in a double dual connection. This connection has been previously studied with the boost power stage in the well-known double dual boost converter. In contrast to the double dual boost, which can only be used as a dc-dc converter, the double dual buck can be used as an inverter. Furthermore, it has a non-pulsating voltage from the input terminals to the output terminals. This property is exploited to reduce the common-mode current, which is of special interest in transformer-less photovoltaic applications, among others. The study includes a model description of the system in terms of the differential and common-mode variables. A controller based on this model representation is proposed to alleviate the effects of the common-mode component of the inverter output voltage on the leakage ground current. The analysis shows that the double-dual buck based inverter in closed-loop with the proposed controller exhibits a considerably reduced leakage-ground current, i.e., an almost negligible common-mode current flowing through the ground-path. This natural benefit makes it an attractive option for applications such as grid-tied inverters for renewable energy systems and electric vehicles. An efficiency analysis is also provided considering a conventional modulation scheme. Finally, the system performance is evaluated in a 1 kW experimental setup. © 2021 Elsevier Ltd.

Rosas-Caro, J. C., Escobar, G., Martinez-Rodriguez, P. R., Iturriaga-Medina, S., Mayo-Maldonado, J. C., & Valdez-Resendiz, J. E. (2021). Differential and common-mode model-based controller for the double-dual buck transformerless inverter. *International Journal of Electrical Power and Energy Systems*, 131. Art. 107065. doi: 10.1016/j.ijepes.2021.107065. Article.

Julio César Rosas Caro

SNI Nivel I

Abraham Mendoza Andrade

Investigador Titular D, SNI Nivel I

DIFFERENTIAL EVOLUTION BASED ALGORITHM FOR OPTIMAL CURRENT RIPPLE CANCELATION IN AN UNEQUAL INTERLEAVED POWER CONVERTER

ABSTRACT. This paper proposes an optimal methodology based on the Differential Evolution algorithm for obtaining the set of duty cycles of a recently proposed power electronics converter with input current ripple cancellation capability. The converter under study was recently introduced to the state-of-the-art as the interleaved connection of two unequal converters to achieve low input current ripple. A latter contribution proposed a so-called proportional strategy. The strategy can be described as the equations to relate the duty cycles of the unequal power stages. This article proposes a third switching strategy that provides a lower input current ripple than the proportional strategy. This is made by considering duty cycles independently of each other instead of proportionally. The proposed method uses the Differential Evolution algorithm to determine the optimal switching pattern that allows high quality at the input current side, given the reactive components, the switching frequency, and power levels. The mathematical model of the converter is analyzed, and thus, the decision variables and the optimization problem are well set. The proposed methodology is validated through numerical experimentation, which shows that the proposed method achieves lower input current ripples than the proportional strategy. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

Rosas-Caro, J. C., García-Vite, P. M., Rodríguez, A., Mendoza, A., Alejo-Reyes, A., Cuevas, E., & Beltrán-Carbajal, F. (2021). Differential evolution based algorithm for optimal current ripple cancellation in an unequal interleaved power converter. *Mathematics*, 9(21). Art. 2755 doi: 10.3390/math9212755. Article.

Julio César Rosas Caro

SNI Nivel I

DISCRETE-TIME MODELING AND CONTROL OF DOUBLE DUAL BOOST CONVERTERS WITH IMPLICIT CURRENT RIPPLE CANCELLATION OVER A WIDE OPERATING RANGE

ABSTRACT. This article introduces discrete-time controllers for double dual boost converters, suitable for renewable energy applications. The proposed schemes are based on a current ripple mitigation technique,

which enables an unconstrained input-to-output voltage converter gain. This is in contrast with classical interleaved topology implementations, where duty cycles are restricted (e.g., to 50%). A discrete-time small-signal controller is proposed for those applications that require nominal specifications. This control strategy is based on a novel linear difference system approach, whereas gain tuning is performed via numerical computation of linear matrix inequalities. In addition, a discrete-time large-signal controller is proposed for those applications that require trajectory tracking. The proposed controllers, their stability, performance, and ripple cancellation properties are validated via experimental results. © 1982-2012 IEEE.

Villarreal-Hernandez, C. A., Mayo-Maldonado, J. C., Escobar, G., Loranca-Coutino, J., Valdez-Resendiz, J. E., & Rosas-Caro, J. C. (2021). Discrete-Time Modeling and Control of Double Dual Boost Converters with Implicit Current Ripple Cancellation over a Wide Operating Range. *IEEE Transactions on Industrial Electronics*, 68(7), 5966-5977. Art. 9108403. doi: 10.1109/TIE.2020.2996149. Article.

Julio César Rosas Caro

SNI Nivel I

Leonardo Jesús Valdivia Parga

SNI Nivel Candidato

FUEL-CELL ENERGY GENERATION SYSTEM BASED ON THE SERIES-CAPACITOR BOOST CONVERTER

ABSTRACT. This work introduces the development of a power-electronics customizable energy system for their application on renewable energy generation based on proton-exchange membrane fuel cells. The customizable energy system aims to regulate the output voltage from a fuel cell, which has a relatively low amplitude and wide range of variation, to a fixed voltage to feed a grid-tie inverter. The customizable energy system proposed is based on a dc-dc converter for which different configurations (topologies) are available, such as the traditional single-phase boost or the (interleaved) multi-phase boost. The dc-dc converter of the energy system is based on the series-capacitor boost converter, a recently proposed converter that has a similar configuration to the interleaved boost converter. This article shows that the series-capacitor boost topology offers benefits in the proposed application. An experimental prototype was developed and tested in order to demonstrate the advantages of the system proposed. © 2021 Hydrogen Energy Publications LLC.

Rosas-Caro, J. C., Valdez-Resendiz, J. E., Mayo-Maldonado, J. C., Sanchez, V. M., Lopez-Núñez, A. R., Barbosa, R., & Valdivia, L. J. (2021). Fuel-cell energy generation system based on the series-capacitor boost converter. *International Journal of Hydrogen Energy*, 46(51), 26126-26137. doi: 10.1016/j.ijhydene.2021.04.086. Article.

Julio César Rosas Caro

SNI Nivel I

MODEL-BASED AND MODEL-FREE CONTROL OF DC-DC CONVERTERS WITH HIGH-ORDER DYNAMICS AND LIMITED MEASUREMENTS

ABSTRACT. This article introduces a control design framework for modern dc-dc topologies with high-order dynamics. In particular, model-based and model-free approaches using high-order controllers are introduced. The model-based approach permits the use of a minimum number of sensors, even for converters with a high number of components (e.g., multilevel, quadratic, input/output LC filter-based converters, etc.). This setting does not require estimation of state variables and its gain tuning can be achieved by selecting time-response specifications. The proposed model-free approach control exhibits the same, as well as some additional characteristics. Namely, controllers can be synthesized without the requirement of an explicit dynamic model, and gain tuning with guaranteed stability is directly achieved from measurement data. The latter controller is implemented in discrete time, which facilitates a digital implementation. The proposed approaches are validated through the control design and closed-loop implementation of a sixth-order topology. © 1982-2012 IEEE.

Loranca-Coutino, J., Mayo-Maldonado, J. C., Escobar, G., Villarreal-Hernandez, C. A., Maupong, T. M., Valdez-Resendiz, J. E., & Rosas-Caro, J. C. (2021). Model-Based and Model-Free Control of DC-DC Converters With High-Order Dynamics and Limited Measurements. *IEEE Transactions on Industrial Electronics*, 68(8), 6750-6761. doi: 10.1109/TIE.2020.3001845. Article.

Julio César Rosas Caro

SNI Nivel I

Omar Fernando Ruíz Martínez

SNI Nivel Candidato

NONLINEAR STABILIZING CONTROL DESIGN FOR DC-DC CONVERTERS USING LIFTED MODELS

ABSTRACT. This article contains a novel approach to dc-dc converter nonlinear control design, working on continuous conduction mode. In particular, the problem of instability induced by constant power loads is addressed. The proposed setting is based on the use of lifted models in terms of power and energy, obtained from voltage/current observable nonlinear transformations. We show that stability can be imposed on lifted models via control design in a much more direct fashion than in traditional current/voltage coordinates.

To illustrate the versatility of this approach, we propose three different nonlinear controllers with stabilization capabilities, which exploit the advantages of lifted dynamics in a different way. These strategies are experimentally validated and tested under abrupt and intermittent input voltage and load variations. © 1982-2012 IEEE.

Mayo-Maldonado, J. C., Ruiz-Martinez, O. F., Escobar, G., Valdez-Resendiz, J. E., Maupong, T. M., & Rosas-Caro, J. C. (2021). Nonlinear Stabilizing Control Design for DC-DC Converters Using Lifted Models. *IEEE Transactions on Industrial Electronics*, 68(11), 10772-10783. Art. 9234722. doi: 10.1109/TIE.2020.3031530. Article.

Julio César Rosas Caro

SNI Nivel I

OUTPUT VOLTAGE RIPPLE REDUCTION IN A SYMMETRIC MULTISTAGE-STACKED BOOST ARCHITECTURE (MSBA) CONVERTER

ABSTRACT. This article proposes a different operation mode in a recently proposed converter, the multistage-stacked boost architecture (MSBA) converter working under the symmetric operation mode. The operation mode of the converter is analyzed with a modified pulse width modulation (PWM) scheme, in which the switching function of transistors is obtained from an interleaved scheme. The results show that the modified PWM results in a similar operation of the converter, with a reduced output voltage ripple, without increasing the switching frequency. A mathematical model of the converter is provided, the output voltage ripple calculation is performed in the traditional, and the modified PWM scheme, simulation, and experimental results are provided to verify the operation mode and the obtained equations. © 2021 by the author. Licensee MDPI, Basel, Switzerland.

Rosas-Caro, J. C. (2021). Output voltage ripple reduction in a symmetric multistage-stacked boost architecture (Msba) converter. *Electronics (Switzerland)*, 10(4), 1-20. Art. 394. doi: 10.3390/electronics10040394. Article.

Julio César Rosas Caro

SNI Nivel I

Omar Fernando Ruíz Martínez

SNI Nivel Candidato

POWER SHAPING CONTROL OF DC-DC CONVERTERS WITH CONSTANT POWER LOADS

ABSTRACT. This paper deals with the stabilization of DC-DC converters feeding constant power loads (CPLs). It is shown that power/energy

dynamics are easily computed via the image of the input/output voltages/currents of the converter. Such image is represented by a high-order differential operator, obtained from first principles, acting on the variables of a stabilizing interconnected controller. This approach is based upon the premise that the destabilizing effect of CPLs, is caused due to a power imbalance in a dissipation equality, which prevents passivity. The proposed stabilizing mechanism shapes the power dynamics via an interconnected controller, inducing a feasible power flow and thus passivity. To do so, we developed a stability test, as well as control design tools in terms of linear matrix inequalities (LMIs), constructed from coefficient matrices of the system dynamics. As a practical advantage, the proposed power shaping approach permits to link stability conditions with the nominal power rate specification of power converters. Finally, we show that the proposed framework can also accommodate other traditional frequency domain, eigenvalue and immittance criteria. The main results are validated via a theoretical analysis and experimental results. © 2020 Elsevier Ltd

Mayo-Maldonado J. C., Ruiz-Martinez, O. F., Escobar, G., Maupong, T. M., Valdez-Resendiz, J. E. & Rosas-Caro, J. C. (2020). Power shaping control of DC-DC converters with constant power loads. *Control Engineering Practice*, 105. Art. 104639. doi: 10.1016/j.coneng-prac.2020.104639. Article.

Julio César Rosas Caro

SNI Nivel I

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ROBUST CLUSTERING ROUTING METHOD FOR WIRELESS SENSOR NETWORKS CONSIDERING THE LOCUST SEARCH SCHEME

ABSTRACT. Multiple applications of sensor devices in the form of a Wireless Sensor Network (WSN), such as those represented by the Internet of Things and monitoring dangerous geographical spaces, have attracted the attention by several scientific communities. Despite their interesting properties, sensors present an adverse characteristic: they manage very limited energy. Under such conditions, saving energy represents one of the most important concepts in designing effective protocols for WSNs. The objective of a protocol is to increase the network lifetime through the reduction of energy consumed by each sensor. In this paper, a robust clustering routing protocol for WSNs is introduced. The scheme uses the Locust Search (LS-II) method to determine the number of cluster heads and to identify the optimal cluster heads. Once the cluster heads are recognized, the other sensor elements are assigned to

their nearest corresponding cluster head. Numerical simulations exhibit competitive results and demonstrate that the proposed protocol allows for the minimization of the energy consumption, extending the network lifetime in comparison with other popular clustering routing protocols. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

Rodríguez, A., Pérez-Cisneros, M., Rosas-Caro, J. C., Del-Valle-Soto, C., Gálvez, J., & Cuevas, E. (2021). Robust clustering routing method for wireless sensor networks considering the locust search scheme. *Energies*, 14(11). Art. 3019. doi: 10.3390/en14113019. Article.

Julio César Rosas Caro

SNI Nivel I

THE FOURTH-ORDER SINGLE-SWITCH IMPROVED SUPER-BOOST CONVERTER WITH REDUCED INPUT CURRENT RIPPLE

ABSTRACT. This paper introduces a new single switch DC-DC fourth-order boost converter. The proposed converter is the improved version of an existing converter known as the super-boost converter. The improved super-boost ISP converter achieves a smaller input current ripple than the super-boost converter when the same parameters in passive components are used. Conversely, smaller components can be used to achieve the same input current ripple, which leads to a compact and cheaper design. A comparative evaluation showed a reduction of 37.3% of stored energy in inductors to comply with a required input current ripple in comparison with the super-boost converter for a particular design. Experimental results are provided to corroborate this benefit of the ISB proposed topology. © 2019 by the authors. Licensee MDPI, Basel, Switzerland.

Garza-Arias, E., Rosas-Caro, J. C., Valdez-Resendiz, J. E., Mayo-Maldonado, J. C., Escobar-Valderrama, G., Guillen, D., & Rodríguez A. (2021). The fourth-order single-switch improved super-boost converter with reduced input current ripple. *Electronics (Switzerland)*, 10(19). Art. 2379. doi: 10.3390/electronics10192379. Article.

Omar Fernando Ruíz Martínez

SNI Nivel Candidato

Héctor Eduardo Gilardi Velázquez

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SIMPLE DESIGN OF A PFC DEVICE BASED ON SWITCHED CAPACITORS USING ANALOG AND DIGITAL CIRCUITS

ABSTRACT. This document presents the design of a power factor corrector (PFC) using ordinary

analog and digital circuits. The main idea is obtain a circuit that by its simplicity can be integrated in a single chip with external adjusts for different power scenarios. The designed circuit is for single phase systems and is based in the activation of a right sequence of capacitors for compensate power factor (PF). The proposed circuit is validated by simulations made it in Synopsys Saber under variable conditions. © 2020 IEEE.

Ruiz-Martinez, O. F. & Gilardi-Velazquez, H. E. (2020). Simple design of a PFC Device based on Switched Capacitors using Analog and Digital Circuits. 2020 IEEE ANDESCON, ANDESCON 2020, Quito, Ecuador. IEEE ANDESCON, 2020. Art. 9272067. doi: 10.1109/ANDESCON50619.2020.9272067. Conference Paper.

Omar Fernando Ruíz Martínez

SNI Nivel Candidato

STUDY ON MULTIPLE INPUT ASYMMETRIC BOOST CONVERTERS WITH SIMULTANEOUS AND SEQUENTIAL TRIGGERING

ABSTRACT. Paralleled boost asymmetric configurations operating in discontinuous conduction mode (DCM) are suitable for integrating dissimilar green energy generating sources and control algorithms in versatile scenarios where voltage step-up, low cost, stable operation, low output ripple, uncomplicated design, and acceptable efficiency are needed. Unfortunately, research has mainly been conducted on the buck, sepic, switched-capacitor, among other asymmetric configurations operating in continuous conduction mode (CCM), to the authors' knowledge. For asymmetric boost type topologies, achieving simultaneous CCM is not a trivial task, and other problems such as circulating currents arise. Research for interleaved converters cannot be easily extended to asymmetric boost topologies due to the dissimilarity of control algorithms and types of sources and parallel stages. This paper analytically establishes properties of stability, output ripple, output voltage, and design for asymmetrical paralleled boost converters operating in DCM with simultaneous or phase delayed (sequential) triggering. A 300 W experimental design and the respective tests allow validation of such properties, resulting in an easy-to-implement configuration with acceptable efficiency. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

Parada-Salado, J. G., Rodríguez-Licea, M. A., Soriano-Sanchez, A. G., Ruiz-Martínez, O. F., Espinosa-Calderon, A., & Pérez-Pinal, F. J. (2021). Study on multiple input asymmetric boost converters with simultaneous and sequential triggering. *Electronics (Switzerland)*, 10(12). Art. 1421. doi: 10.3390/electronics10121421. Article.

Omar Fernando Ruíz Martínez

SNI Nivel Candidato

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TIME MANAGEMENT OF MODES OF OPERATION FOR SURVIVAL OF A SATELLITE MISSION: POWER SIMULATION IN MATLAB AND STK

ABSTRACT. The space industry in Mexico has been drawing great attention recently from the education sector through the implementation of projects for the design and development of satellite missions, encouraging and motivating students to participate and develop them. In this paper we present a favorable methodology for the energy management and the definition of the operative times of each Mode of Operation of a satellite mission that is being developed by undergraduate students at Universidad Panamericana (UP). This methodology intends to guarantee energy autonomy and safe operation of the satellite, and help students to understand the proper development of energy management, and its important relation with the Modes of Operation. We propose as the methodology, a performance analysis of the energy management components to different power requirements, activation time periods in terms of n orbits, and battery charge-discharge limits scenarios, by performing power simulations in MATLAB and STK. Finally, determine analytically the most optimal scenario that will ensure the survival of the satellite and achieve a successful mission.

Gonzalez, M., Gilardi-Velazquez, H. E., Gutierrez, S., & Ruiz-Martinez, O. F. (2021). Time Management of Modes of Operation for Survival of a Satellite Mission: Power Simulation in MATLAB and STK. *IFAC Papers-onLine*, 54(12), 74-79. doi: 10.1016/j.ifacol.2021.11.012. Conference Paper.

Fidencio Tapia Rodríguez

SNI Nivel Candidato

A REVIEW ON PITOT TUBE ICING IN AERONAUTICS: RESEARCH- DESIGN AND CHARACTERIZATION - FUTURE TRENDS

ABSTRACT. The correct measurement of airspeed is a crucial task since a lot of algorithms for the autopilot are based on it and even human pilots depend completely on this reading to take corrective and non-corrective actions to control the aircraft. This work presents a detailed review concerning an important aspect of aeronautical safety, i.e., Pitot tube (PT) icing. The topics covered

include first the risks present in flight, relating meteorological conditions, and antecedents of air accidents related to the icing of the PT. Then, the principles of operation of the PT, its conventional design, how such design is currently regulated, as well as unique guidance for experimentation of PT. Also discussed are the principal modelling considerations for the numerical analysis of PTs including the proper selection of geometry, governing equations, turbulence models, and boundary conditions for the simulation of different flight circumstances. This guidance for both experimental and numerical analysis is enriched with a well-selected state the art research. Finally, a summary of the most recent advances and future trends is offered. The outcomes of this review exhibit several interesting ideas showing promising results, such as microwave heating of the pitot surroundings, phase change materials that delay ice formation, and even mechanical internal arrangement of bulkheads to prevent the ice to travel through the throat of the probe. The combined research efforts on novel safety measures and new designs for aeronautical PT represent a remarkable potential to improve flight security. © 2021 Elsevier Ltd

Jäckel, R., Gutiérrez-Urueta, G., & Tapia, F. (2021). A review on Pitot tube icing in aeronautics: Research- design and characterization – future trends. *Flow Measurement and Instrumentation*, 81. Art. 102033 doi: 10.1016/j.flowmeasinst.2021.102033. Article.

Antonio Valderrábano González

SNI Nivel I

A NOVEL METHODOLOGY FOR ADAPTIVE COORDINATION OF MULTIPLE CONTROLLERS IN ELECTRICAL GRIDS

ABSTRACT. This proposal is aimed to overcome the problem that arises when diverse regulation devices and controlling strategies are involved in electric power systems regulation design. When new devices are included in electric power system after the topology and regulation goals were defined, a new design stage is generally needed to obtain the desired outputs. Moreover, if the initial design is based on a linearized model around an equilibrium point, the new conditions might degrade the whole performance of the system. Our proposal demonstrates that the power system performance can be guaranteed with one design stage when an adequate adaptive scheme is updating some critic controllers' gains. For large-scale power systems, this feature is illustrated with the use of time domain simulations, showing the dynamic behavior of the significant variables. The transient response is enhanced in terms of maximum overshoot and settling time. This is demonstrated

using the deviation between the behavior of some important variables with StatCom, but without or with PSS. A B-Spline neural networks algorithm is used to define the best controllers' gains to efficiently attenuate low frequency oscillations when a short circuit event is presented. This strategy avoids the parameters and power system model dependency; only a dataset of typical variable measurements is required to achieve the expected behavior. The inclusion of PSS and StatCom with positive interaction, enhances the dynamic performance of the system while illustrating the ability of the strategy in adding different controllers in only one design stage.

Tapia-Olvera, R., Beltran-Carbajal, F., Valderrábano-Gonzalez, A., & Aguilar-Mejia, O. (2021). A Novel Methodology for Adaptive Coordination of Multiple Controllers in Electrical Grids. *Mathematics*, 9(13). Art. 1474. doi: 10.3390/math9131474. Article.

Antonio Valderrábano González

SNI Nivel I

ADAPTIVE NEURONAL INDUCTION MOTOR CONTROL WITH AN 84-PULSE VOLTAGE SOURCE CONVERTER

ABSTRACT. This paper deals with the problem of harmonic distortion in velocity control drives for large horsepower three-phase induction motors. A new solution alternative to considerably reduce harmonic distortion in controlled large-capacity induction motors is introduced. An adaptive neural velocity reference trajectory tracking control scheme based on an 84-pulse voltage source converter for large horsepower three-phase induction motors is proposed. Desired flux modulus control is simultaneously performed. Adaptive controller parameters are adjustable online using B-spline artificial neural networks. Variable load torque of the handled mechanical dynamic system is assumed to be uncertain. Real-time estimations or measurements of dynamic load torque are unnecessary. Bézier curves are used for desired smooth motion planning to take a large induction motor from its starting towards an operating velocity. Moreover, motion planning is exploited for evasion of harmful mechanical oscillations as well as large peak values of voltages and currents. Closed-loop efficient velocity profile tracking is confirmed on a 500-hp induction motor. Comparisons with 6-pulse and 12-pulse conventional voltage source converters are also included to highlight the superior energy efficiency of the proposed 84-pulse ac motor drive. A very low total harmonic distortion of the multiple-pulse reconstructed three-phase control voltage signals is also proved. Analytical and numerical results prove the effectiveness and

efficiency of the introduced 84-pulse adaptive neuronal dynamic tracking control strategy.

Beltran-Carbajal, F., Tapia-Olvera, R., Valderrábano-Gonzalez, A., & Lopez-Garcia, I. (2020). Adaptive neuronal induction motor control with an 84-pulse voltage source converter. *Asian Journal of Control*, 23(4), 1603-1616. doi: 10.1002/asjc.2322. Article.

Antonio Valderrábano González

SNI Nivel I

Julio César Rosas Caro

SNI Nivel I

DESIGN METHODOLOGY FOR INTERFACING DERs TO POWER SYSTEMS THROUGH VSC

ABSTRACT. This paper presents a methodology to connect distributed energy resources via an 84-pulse voltage source converter to three-phase system grid or load of standard or nonstandard voltage values. Transfer function blocks are included to illustrate interfacing among converters. The main input-output values to be considered in the application are detailed and the system can be modified to be included in other systems without loss of generality. The definition of the reactive component for supporting grid or load variations without degrading the overall performance is carried by the DC-DC converter. A control variable for reducing the DC gain is used to improve the settling time. Our proposal defines the capacitive and inductive component values for an operating point and gives the option to reduce them when adding smoothed variations and adaptive controllers. © 2021 A. Valderrábano-Gonzalez et al.

Valderrábano-Gonzalez, A., Beltran-Carbajal, F., Tapia-Olvera, R., Aguilar-Mejia, O., & Rosas-Caro, J. C. (2021). Design Methodology for Interfacing DERs to Power Systems through VSC. *Mathematical Problems in Engineering*, 2021. Art. 5541375. doi: 10.1155/2021/5541375. Article.

Carolina del Valle Soto

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Leonardo Jesús Valdivia Parga

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José Alberto del Puerto Flores

Profesor investigador

A LOW-COST DIGITAL VITAL SIGNS CAPTURER FOR OLDER ADULTS: DESIGN, DEVELOPMENT, AND IMPLEMENTATION

ABSTRACT. Nowadays, information technologies are increasingly accessible to the majority of the

population. This has made it possible to promote the use of the Internet of Things (IoT). One of the industries with the greatest challenges is the health sector, although technology has arrived and has been implemented in the health sector, in developing countries, there is a very low budget that makes the adoption of new technologies impossible. Therefore, older adults will be a vulnerable sector throughout the world and especially in poor countries. For this reason, in this article, we present the design, development, and implementation of a low-cost digital vital signs (VS) capturer. This device allows reducing the time in taking VS, but above all the device allows eliminating the task of handwriting information in a logbook since the information is automatically sent to a central computer, which will reduce human errors. © 2012 IEEE.

Valdivia, L. J., Del-Valle-Soto, C., Del Puerto-Flores, J., Arrobo-Moncayo, S., & Gomez-Aceves, K. (2020). A low-cost digital vital signs capturer for older adults: design, development and implementation. *IEEE Consumer Electronics Magazine*, 10(3), 56-63. Art. 9271826. doi: 10.1109/MCE.2020.3040722. Article.

Carolina del Valle Soto

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SNI Nivel I

A LOW-COST JAMMING DETECTION APPROACH USING PERFORMANCE METRICS IN CLUSTER-BASED WIRELESS SENSOR NETWORKS

ABSTRACT. Wireless Sensor Networks constitute an important part of the Internet of Things, and in a similar way to other wireless technologies, seek competitiveness concerning savings in energy consumption and information availability. These devices (sensors) are typically battery operated and distributed throughout a scenario of particular interest. However, they are prone to interference attacks which we know as jamming. The detection of anomalous behavior in the network is a subject of study where the routing protocol and the nodes increase power consumption, which is detrimental to the network's performance. In this work, a simple jamming detection algorithm is proposed based on an exhaustive study of performance metrics related to the routing protocol and a significant impact on node energy. With this approach, the proposed algorithm detects areas of affected nodes with minimal energy expenditure. Detection is evaluated for four known cluster-based protocols: PEGASIS, TEEN, LEACH, and HPAR. The experiments analyze the protocols'

performance through the metrics chosen for a jamming detection algorithm. Finally, we conducted real experimentation with the best performing wireless protocols currently used, such as Zigbee and LoRa. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

Del-Valle-Soto, C., Mex-Perera, C., Nolasco-Flores, J. A., Rodríguez, A., Rosas-Caro, J. C., & Martínez-Herrera, A. F. (2021). A low-cost jamming detection approach using performance metrics in cluster-based wireless sensor networks. *Sensors* (Switzerland), 21(4), 1-28. Art. 1179. doi: 10.3390/s21041179. Article.

Carolina del Valle Soto

Investigadora Titular D, SNI Nivel I

A METAHEURISTIC SCHEME BASED ON THE HUNTING MODEL OF YELLOW SADDLE GOATFISH

ABSTRACT. Animals have demonstrated clever hunting strategies when they collaborate with each other. These techniques involve swarm intelligence and have been applied to develop bio-inspired algorithms, a research field for solving optimization problems. In the last years, several methods arise from inspiration in nature to model collective animal behavior. © 2021, The Author(s), under exclusive license to Springer Nature Switzerland AG.

Cuevas, E., Rodríguez, A., Alejo-Reyes, A., & Del-Valle-Soto, C. (2021). A Metaheuristic Scheme Based on the Hunting Model of Yellow Saddle Goatfish. In E. Cuevas, A. Rodríguez, A. Alejo-Reyes, & C. Del-Valle-Soto (eds.), *Recent Metaheuristic Computation Schemes in Engineering*, vol. 948, (pp. 11-61). Springer. doi: 10.1007/978-3-030-66007-9_2. Book Chapter.

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BLOOD VESSEL SEGMENTATION USING DIFFERENTIAL EVOLUTION ALGORITHM

ABSTRACT. In the last years, medical image processing has become an important tool for health care. In particular, the analysis of retinal vessel images has become crucial for achieving a more accurate diagnosis and treatment for several cardiovascular and ophthalmological diseases. However, this task is extremely hard and time-consuming, often requiring human supervised segmentation of fundus images as well as some degree of professional skills. An automatic yet accurate procedure for retinal vessel segmentation is essential to assist ophthalmologists with

illness detection. Several retinal vessel segmentation methods have been developed with satisfactory results. Nevertheless, the image preprocessing techniques implemented in this kind of procedure is known to have poor performance, mainly due to the complex nature of retinal vessel imaging. To improve the image preprocessing stage, a fast and accurate approach for retinal vessel segmentation is presented. This approach aims to enhance the contrast between retinal vessels and the image's background by implementing a natural inspired technique called Lateral Inhibition (LI). Additionally, a cross-entropy minimization procedure based on Differential Evolution (DE) is applied to find the appropriate threshold and then used to define whether an image pixel is a vessel or non-vessel. The described method has been tested by considering two well-known image databases: DRIVE and STARE. The obtained results are compared against those of other related methods in order to prove the accuracy, effectiveness, and robustness of the presented approach. © 2021, The Author(s), under exclusive license to Springer Nature Switzerland AG.

Cuevas, E., Rodríguez, A., Alejo-Reyes, A., & Del-Valle-Soto, C. (2021). Blood Vessel Segmentation Using Differential Evolution Algorithm. In E. Cuevas, A. Rodríguez, A. Alejo-Reyes, & C. Del-Valle-Soto (eds.), *Recent Metaheuristic Computation Schemes in Engineering*, vol. 948, (pp. 151-167). Springer. doi: 10.1007/978-3-030-66007-9_5. Book Chapter.

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CARRIER DIVERSITY INCORPORATION TO LOW-COMPLEXITY NEAR-ML DETECTION FOR MULTICARRIER SYSTEMS OVER V2V RADIO CHANNEL

ABSTRACT. Inter-carrier interference (ICI) in vehicle to vehicle (V2V) orthogonal frequency division multi-plexing (OFDM) systems is a common problem that makes the process of detecting data a demanding task. Mitigation of the ICI in V2V systems has been addressed with linear and non-linear iterative receivers in the past; however, the former requires a high number of iterations to achieve good performance, while the latter does not exploit the channel's frequency diversity. In this paper, a transmission and reception scheme for low complexity data detection in doubly selective highly time varying channels is proposed. The technique couples the discrete Fourier transform

spreading with non-linear detection in order to collect the available channel frequency diversity and successfully achieving performance close to the optimal maximum likelihood (ML) detector. When compared with the iterative LMMSE detection, the proposed system achieves a higher performance in terms of bit error rate (BER), reducing the computational cost by a third-part when using 48 subcarriers, while in an OFDM system with 512 subcarriers, the computational cost is reduced by two orders of magnitude. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

Del Puerto-Flores, J. A., Peña-Campos, F., Parra-Michel, R., & Del-Valle-Soto, C. (2021). Carrier diversity incorporation to low-complexity near-ml detection for multicarrier systems over v2v radio channel. *Sensors*, 21(18). Art. 6067. doi: 10.3390/s21186067. Article.

Carolina del Valle Soto

Investigadora Titular D, SNI Nivel I

CLUSTERING MODEL BASED ON THE HUMAN VISUAL SYSTEM

ABSTRACT. Clustering involves the process of dividing a collection of abstract objects into a number of groups, which are integrated with similar elements. Several clustering methods have been introduced and developed in the literature with different performance levels. Among such approaches, density algorithms present the best advantages, since they are able to find clusters from a dataset under different scales, shapes, and densities without requiring the number of groups as input. On the other hand, there are processes that humans perform much better than deterministic approaches or computers. In fact, humans can visually cluster data exceptionally well without the necessity of any training. Under this unique capability, clustering, instantaneous, and effortless for humans, represents a fundamental challenge for artificial intelligence. In this chapter, a simple clustering model inspired by the way in which the human visual system associates patterns spatially is presented. The model, at some abstraction level, can be characterized as a density grouping strategy. The approach is based on Cellular Neural Networks (CNNs), which have demonstrated to be the best models for emulating the human visual system. In the method, similar to the biological model, CNN is used to build especially groups while an automatic mechanism tries different resolution scales to find the best possible data categorization. Different datasets have been adopted to evaluate the performance of the algorithm. Their results are also compared with popular density clustering techniques from the liter-

ature. Computational results demonstrate that the CNN approach presents competitive results in comparison with other algorithms regarding accuracy and robustness. © 2021, The Author(s), under exclusive license to Springer Nature Switzerland AG.

Cuevas, E., Rodríguez, A., Alejo-Reyes, A., & Del-Valle-Soto, C. (2021). Clustering Model Based on the Human Visual System. In E. Cuevas, A. Rodríguez, A. Alejo-Reyes, & C. Del-Valle-Soto (eds.), *Recent Metaheuristic Computation Schemes in Engineering*, vol. 948, (pp. 169-192). Springer. doi: 10.1007/978-3-030-66007-9_6. Book Chapter.

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CORNER DETECTION ALGORITHM BASED ON CELLULAR NEURAL NETWORKS (CNN) AND DIFFERENTIAL EVOLUTION (DE)

ABSTRACT. Corner detection represents one of the most important steps to identify features in images. Due to their powerful local processing capabilities, Cellular Nonlinear/Neural Networks (CNN) are commonly utilized in image processing applications such as image edge detection, image encoding and image hole filling. CNN perform well for locating corner features in binary images. However, their use in grayscale images has not been considered due to their design difficulties. In this chapter, a corner detector based on CNN for grayscale images is presented. In the approach, the original processing scheme of the CNN is modified to include a nonlinear operation for increasing the contrast of the local information in the image. With this adaptation, the final CNN parameters that allow the appropriate detection of corner points are estimated through the Differential evolution algorithm by using standard training images. Different test images have been used to evaluate the performance of the presented corner detector. Its results are also compared with popular corner methods from the literature. Computational simulations demonstrate that the presented CNN approach presents competitive results in comparison with other algorithms in terms of accuracy and robustness. © 2021, The Author(s), under exclusive license to Springer Nature Switzerland AG.

Cuevas, E., Rodríguez, A., Alejo-Reyes, A., & Del-Valle-Soto, C. (2021). Corner Detection Algorithm Based on Cellular Neural Networks (CNN) and Differential Evolution (DE). In E. Cuevas, A. Rodríguez, A. Alejo-Reyes, & C. Del-Valle-Soto (eds.), *Recent Metaheuristic Computation Schemes in Engineering*, vol. 948, (pp. 125-149). Springer. doi: 10.1007/978-3-030-66007-9_4. Book Chapter.

Carolina del Valle Soto
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Ramiro Velázquez Guerrero
SNI Nivel I

FPGA BASED TECHNICAL SOLUTIONS FOR HIGH THROUGHPUT DATA PROCESSING AND ENCRYPTION FOR 5G COMMUNICATION: A REVIEW

ABSTRACT. The field programmable gate array (FPGA) devices are ideal solutions for high-speed processing applications, given their flexibility, parallel processing capability, and power efficiency. In this review paper, at first, an overview of the key applications of FPGA-based platforms in 5G networks/systems is presented, exploiting the improved performances offered by such devices. FPGA-based implementations of cloud radio access network (C-RAN) accelerators, network function virtualization (NFV)-based network slicers, cognitive radio systems, and multiple input multiple output (MIMO) channel characterizers are the main considered applications that can benefit from the high processing rate, power efficiency and flexibility of FPGAs. Furthermore, the implementations of encryption/decryption algorithms by employing the Xilinx Zynq Ultrascale+MPSoC ZCU102 FPGA platform are discussed, and then we introduce our high-speed and lightweight implementation of the well-known AES-128 algorithm, developed on the same FPGA platform, and comparing it with similar solutions already published in the literature. The comparison results indicate that our AES-128 implementation enables efficient hardware usage for a given data-rate (up to 28.16 Gbit/s), resulting in higher efficiency (8.64 Mbps/slice) than other considered solutions. Finally, the applications of the ZCU102 platform for high-speed processing are explored, such as image and signal processing, visual recognition, and hardware resource management. © 2021. All Rights Reserved.

Visconti, P., Velazquez, R., Del-Valle-Soto, C., & De Fazio, R. (2021). FPGA based technical solutions for high throughput data processing and encryption for 5G communication: A review. *Telkomnika*, 19(4), 1291-1306. doi: 10.12928/TELKOMNIKA.v19i4.18400. Article.

Carolina del Valle Soto
Investigadora Titular D, SNI Nivel I

INTRODUCTORY CONCEPTS OF METAHEURISTIC COMPUTATION

ABSTRACT. This chapter presents the main concepts of metaheuristic schemes. The objective

of this chapter is to introduce the characteristics and properties of these approaches. An important propose of this chapter is also to recognize the importance of metaheuristic methods to solve optimization problems in the cases in which traditional techniques are not suitable. © 2021, The Author(s), under exclusive license to Springer Nature Switzerland AG.

Cuevas, E., Rodríguez, A., Alejo-Reyes, A., & Del-Valle-Soto, C. (2021). Introductory Concepts of Metaheuristic Computation. In E. Cuevas, A. Rodríguez, A. Alejo-Reyes, & C. Del-Valle-Soto (eds.), *Recent Metaheuristic Computation Schemes in Engineering*, vol. 948, (pp. 1-9). Springer. doi: 10.1007/978-3-030-66007-9_1. Book Chapter.

Carolina del Valle Soto
Investigadora Titular D, SNI Nivel I

METAHEURISTIC ALGORITHMS APPLIED TO THE INVENTORY PROBLEM

ABSTRACT. Almost all industries and businesses make purchases; they usually have more than one possible supplier; in most cases, they have many possible suppliers, since suppliers have different prices, policies, different levels of quality. Making wise decisions may save money, which has an impact on the final price of products, and therefore, on the company's competitiveness. The problem can be solved using mathematical models to represent the cost of the inventory management, and finally, applying techniques to minimize the cost. Mathematical models of the inventory management problem may be complex and NP-hard, and as a result, evaluating all possible solutions to find the cheapest one may be unfeasible, even with a computer. When that happens, metaheuristic algorithms may be used to find a reasonable solution in a reasonable amount of time. This chapter deals with this topic. This chapter presents an example problem, in order to illustrate the complexity of the inventory management and how a large number of possible solutions may arise, then it solves the problem with traditional and metaheuristic algorithms to demonstrate the advantages of metaheuristic algorithms. Finally, other problems are discussed, and further information about algorithms is provided. © 2021, The Author(s), under exclusive license to Springer Nature Switzerland AG.

Cuevas, E., Rodríguez, A., Alejo-Reyes, A., & Del-Valle-Soto, C. (2021). Metaheuristic Algorithms Applied to the Inventory Problem. In E. Cuevas, A. Rodríguez, A. Alejo-Reyes, & C. Del-Valle-Soto (eds.), *Recent Metaheuristic Computation Schemes in Engineering*, vol. 948, (pp. 237-277). Springer. doi: 10.1007/978-3-030-66007-9_8. Book Chapter.

Carolina del Valle Soto
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METAHEURISTIC ALGORITHM BASED ON HYBRIDIZATION OF INVASIVE WEED OPTIMIZATION ASND ESTIMATION DISTRIBUTION METHODS

ABSTRACT. Hybrid metaheuristic methods combine approaches extracted from different techniques to build a single optimization method. The design of such systems represents a current trend in the metaheuristic optimization literature. In hybrid algorithms, the objective is to extend the potential advantages of the integrated approaches and eliminates their main drawbacks. In this chapter, a hybrid method for solving optimization problems is presented. The presented approach combines (1) the explorative characteristics of the invasive weed optimization (IWO) method, (2) the probabilistic models of the estimation distribution algorithms (EDA), and (3) the dispersion capacities of a mixed Gaussian-Cauchy distribution to produce its own search strategy. With these mechanisms, the method conducts an optimization strategy over search areas that deserve a special interest according to a probabilistic model and the fitness value of the existent solutions. In the presented method, each individual of the population generates new elements around its own location, dispersed according to the mixed distribution. The number of new elements depends on the relative fitness value of the individual regarding the complete population. After this process, a group of promising solutions is selected from the set compound by the (1) new elements and the (2) original individuals. Based on the selected solutions, a probabilistic model is built from which a certain number of members (3) is sampled. Then, all the individuals of the sets (1), (2), and (3) are joined in a single group and ranked in terms of their fitness values. Finally, the best elements of the group are selected to replace the original population. This process is repeated until a termination criterion has been reached. To test the performance of the method, several comparisons to other well-known metaheuristic methods has been conducted. The comparison consists of analyzing the optimization results over different standard benchmark functions within a statistical framework. Conclusions based on the comparisons exhibit the accuracy, efficiency, and robustness of the presented approach. © 2021, The Author(s), under exclusive license to Springer Nature Switzerland AG.

Cuevas, E., Rodríguez, A., Alejo-Reyes, A., & Del-Valle-Soto, C. (2021). Metaheuristic Algorithm Based on Hybridization of Invasive Weed Optimization asnd Estimation Distribution Methods. In E. Cuevas, A. Rodríguez, A. Alejo-Reyes, & C. Del-Valle-Soto (eds.), *Recent Metaheuristic Computation Schemes in Engineering*, vol. 948, (pp. 63-123). Springer. doi: 10.1007/978-3-030-66007-9_3. Book Chapter.

Carolina del Valle Soto
Investigadora Titular D, SNI Nivel I

METAHEURISTIC ALGORITHMS FOR WIRELESS SENSOR NETWORKS

ABSTRACT. This chapter presents the main concepts of metaheuristic schemes for Wireless Sensor Networks (WSNs). WSNs are multi-functional, low-cost, and low-power networks and rely on communications among devices, from sensor nodes to one or more sink nodes. Sink nodes, sometimes called coordinator nodes or root nodes, may be more robust and have larger processing capacity than the other nodes. © 2021, The Author(s), under exclusive license to Springer Nature Switzerland AG.

Cuevas, E., Rodríguez, A., Alejo-Reyes, A., & Del-Valle-Soto, C. (2021). Metaheuristic Algorithms for Wireless Sensor Networks. In E. Cuevas, A. Rodríguez, A. Alejo-Reyes, & C. Del-Valle-Soto (eds.), *Recent Metaheuristic Computation Schemes in Engineering*, vol. 948, (pp. 193-235). Springer. doi: 10.1007/978-3-030-66007-9_7. Book Chapter.

Carolina del Valle Soto
Investigadora Titular D, SNI Nivel I

SOLVING ROUTING AND SPECTRUM ALLOCATION PROBLEMS IN FLEXGRID OPTICAL NETWORKS USING PRE-COMPUTING STRATEGIES

ABSTRACT. Flexible optical network architectures are considered a very promising solution where spectrum resources are allocated within flexible frequency grids. This paper presents a minimum spectrum utilization (SU) and average path length (APL) approach to solve the (off-line) routing and spectrum allocation problem (RSA) based on combining a simple ordering pre-computation strategy, namely most subcarriers first (MSF) with three nature-inspired algorithms. These algorithms are ant colony optimization, differential evolution based relative position indexing (DE-RPI), and differential evolution general combinatorial (DE-GC). We begin by showing that MSF is the most effective ordering pre-computation strategy when compared to other well-known typical heuristics in the literature, such as first-fit, and longest path first. Then, we apply MSF in combination with the three nature-inspired algorithms to simultaneously optimize the SU and APL. The usefulness of MSF ordering pre-computation strategy is presented via a comparison of results obtained when using and not using MSF under the same scenarios. The algorithms are evaluated in benchmark optical networks, such as the NSFNet, the European optical network,

and the 40-node USA network. We show that DE-RPI with MSF ordering pre-computation is the best option to solve the RSA problem, obtaining an average improvement percentage in the range of 0.9772–4.4086% on the SU and from - 0.1668 to 0.8511% on the APL when compared to other meta-heuristics, either with or without the MSF ordering policy. © 2020, Springer Science+Business Media, LLC, part of Springer Nature.

Lezama, F., Martínez-Herrera, A. F., Castañón, G., Del-Valle-Soto, C., Sarmiento, A. M., & de Cote, E. M. (2020). Solving routing and spectrum allocation problems in flexgrid optical networks using pre-computing strategies. *Photonic Network Communications*, 41(1), 17-35. doi: 10.1007/s11107-020-00918-4. Article.

Carolina del Valle Soto

Investigadora Titular D, SNI Nivel I

Juan Carlos López Pimentel

Profesor investigador

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SUSTAINABLE PROJECT-BASED LEARNING METHODOLOGY ADAPTABLE TO TECHNOLOGICAL ADVANCES FOR WEB PROGRAMMING

ABSTRACT. The fast pace of development of the Internet and the Coronavirus Disease (COVID-19) pandemic have considerably impacted the educative sector, encouraging the constant transformation of the teaching/learning strategies and more in technological areas as Educational Software Engineering. Web programming, a fundamental topic in Software Engineering and Cloud-based applications, deals with various critical challenges in education, such as learning continuous emerging technological tools, plagiarism detection, generating innovative learning environments, among others. Continual change and even more change with the current digitization becomes a challenge for teachers and students who cannot depend on traditional educational methods. The article presents a sustainable teaching/learning methodology for web programming courses in Engineering Education using project-based learning adaptable to the continuous web technological advances. The methodology has been developed and improved during 9 years, 15 groups, and 3 different universities. Our results demonstrate that the methodology is adaptable with new technologies that might arise; it also presents the advantages of avoiding plagiarism in students and a personalized induction for every specific student in the learning process. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

López-Pimentel, J. C., Medina-Santiago, A., Alcaraz-Rivera, M., & Del-Valle-Soto, C. (2021). Sustainable project-based learning methodology adaptable to technological advances for web programming. *Sustainability* (Switzerland), 13(15). Art. 8482. doi: 10.3390/su13158482. Article.

Carolina del Valle Soto

Investigadora Titular D, SNI Nivel I

THE USE OF ELLIPSE-BASED ESTIMATOR AS A SUB-KEY DISTINGUISHER FOR SIDE-CHANNEL ANALYSIS

ABSTRACT. Side-Channel Analysis has become a relevant tool to analyze a cryptographic device. Here, an adversary looks for information leakage from emanation sources such as power consumption, thus obtaining sensitive information with a lower effort than the mathematical approach. In this manuscript, a distinguisher based on the Mahalanobis distance is applied. Instead of computing an inverse covariance matrix because of lack-sampling problems with tested datasets, a shrinkage calculation is implemented, thus obtaining efficient Mahalanobis distance implementations. The current approach is evaluated using different standardized tests such as stability and success probability, which are computed using unmasked public traces obtained from the Advanced Encryption Standard's typical implementations with a 128-bit key. We show that this technique's efficiency is better than Pearson correlation using few traces in terms of probability detection. © 2021 Elsevier Ltd.

Martínez-Herrera, A. F., Mex-Perera, C., Mancillas-López, C., Del-Valle-Soto, C., & Bossuet, L. (2021). The use of ellipse-based estimator as a sub-key distinguisher for Side-Channel Analysis. *Computers and Electrical Engineering*, 94. Art. 107311. doi: 10.1016/j.compeleceng.2021.107311. Article.

Carolina del Valle Soto

Investigadora Titular D, SNI Nivel I

Ramiro Velázquez Guerrero

SNI Nivel I

Ricardo Tachiquín Gutiérrez

Profesor investigador

WEARABLE URBAN MOBILITY ASSISTIVE DEVICE FOR VISUALLY IMPAIRED PEDESTRIANS USING A SMARTPHONE AND A TACTILE-FOOT INTERFACE

ABSTRACT. This paper reports on the progress of a wearable assistive technology (AT) device designed to enhance the independent, safe, and efficient mobility of blind and visually impaired pedestrians

in outdoor environments. Such device exploits the smartphone's positioning and computing capabilities to locate and guide users along urban settings. The necessary navigation instructions to reach a destination are encoded as vibrating patterns which are conveyed to the user via a foot-placed tactile interface. To determine the performance of the proposed AT device, two user experiments were conducted. The first one requested a group of 20 voluntary normally sighted subjects to recognize the feedback provided by the tactile-foot interface. The results showed recognition rates over 93%. The second experiment involved two blind voluntary subjects which were assisted to find target destinations along public urban pathways. Results show that the subjects successfully accomplished the task and suggest that blind and visually impaired pedestrians might find the AT device and its concept approach useful, friendly, fast to master, and easy to use. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

Tachiquín, R., Velázquez, R., Del-Valle-Soto, C., Gutiérrez, C. A., Carrasco, M., De Fazio, R., Trujillo-León, A., Visconti, P., & Vidal-Verdú, F. (2021). Wearable urban mobility assistive device for visually impaired pedestrians using a smartphone and a tactile-foot interface. *Sensors*, 21(16). Art. 5274. doi: 10.3390/s21165274. Article.

Eduardo de la Vega Segura

Profesor investigador

FRACTIONAL DERIVATIVE-BASED PERFORMANCE ANALYSIS OF HYBRID THERMOELECTRIC GENERATOR-CONCENTRATOR PHOTOVOLTAIC SYSTEM

ABSTRACT. Concentrator photovoltaic systems get the highest conversion efficiencies among all solar applications. However, they need to increase their efficiency even more to compete with traditional photovoltaic systems. The hybridization with thermoelectric generators allows recovering part of the waste heat and converting it to electricity, enhancing the global efficiency. The physical model of hybrid thermoelectric-concentrator photovoltaic module involves five non-linear equations. In this paper, two adapted Newton-Raphson methods using fractional derivatives are developed to solve such non-linear system, one using the conformable derivative operator and the other using the Riemann-Liouville fractional derivative. Both methods are mathematically innovative and are applied within the photovoltaic field for the first time. They can be used in energy prediction or in design optimisation. As an example of application, one month of real atmospheric data from Jaen, Southern Spain, were processed with the help of the developed methods. The performance outputs of the hybrid system were analysed giving interesting findings on their real behaviour, which

is largely unknown nowadays. Linear functions dependent on direct normal irradiance can approximate the total generated power with 12.8 W/m² root mean squared error and, the thermoelectric efficiency with 0.08% error. © 2021 Elsevier Ltd.

De-la-Vega, E., Torres-Hernandez, A., Rodrigo, P. M., & Brambila-Paz, F. (2021). Fractional derivative-based performance analysis of hybrid thermoelectric generator-concentrator photovoltaic system. *Applied Thermal Engineering*, 193. Art. 116984. doi: 10.1016/j.applthermaleng.2021.116984. Article.

Ramiro Velázquez Guerrero

SNI Nivel I

Fernando Dávalos Hernández

Profesor investigador

A COMPARATIVE STUDY OF ENERGY STORAGE SYSTEMS BASED ON MODULAR MULTILEVEL CONVERTERS

ABSTRACT. With the rapid increase of renewable sources connected to the grid, a viable solution to ensure its stability is by deploying distributed Energy Storage Systems (ESS) along the grid. ESS should be capable of managing high-power ratings in short periods of time, thus supercapacitors (SCs) are attractive candidates to fulfill this requirement. ESS topologies based on the Modular Multilevel Converters (MMC) are both expandable and scalable in a manner that avoids the complexity of current systems. In this paper, we present a comparative study of multiple ESS through numerical simulations together with an application optimization for different scenarios. © 2021 IEEE.

Hernandez, F. D., Ibanez, F., Samanbakhsh, R., & Velazquez, R. (2021). A Comparative Study of Energy Storage Systems based on Modular Multilevel Converters. 47th Annual Conference of the IEEE Industrial Electronics Society, IECON 2021, Toronto, Canada. *IECON Proceedings*, 2021. doi: 10.1109/IECON48115.2021.9589539. Conference Paper.

Ramiro Velázquez Guerrero

SNI Nivel I

Ricardo Macías Quijas

Profesor investigador

A NOVEL ELECTRONIC NOSE INSTRUMENT FOR THE DETECTION OF VOLATILE HAZARDOUS COMPOUNDS: PRELIMINARY RESULTS

ABSTRACT. In this paper, the development and preliminary results of a new low-cost electronic nose (e-nose) instrument based on an array of six electrochemical sensors is presented. The aim of such instrument is to detect volatile compounds that

might be hazardous for humans such as methane, combustible gas, carbon monoxide, hydrogen, and smoke, among others. In particular, this work focuses on sensor characterization; the sensors' sensitivity, behavior face to temperature, and step response were experimentally analyzed. Preliminary results with the e-nose prototype show the behavior of the set of sensors. Further signal classification possibilities are presented and discussed. © 2021 IEEE.

Macías-Quijas, R., Velázquez, R., Giannoccaro, N. I., & Lay-Ekuakille, A. (2021). A Novel Electronic Nose Instrument for the Detection of Volatile Hazardous Compounds: Preliminary Results. 7th International Conference on Control, Instrumentation and Automation. ICCIA, 2021. Art. 9403595. doi: 10.1109/ICCIA52082.2021.9403595. Conference Paper.

Ramiro Velázquez Guerrero

SNI Nivel I

A SURVEY ON AGEING MECHANISMS IN II AND III- GENERATION PV MODULES: ACCURATE MATRIX-METHOD BASED ENERGY PREDICTION THROUGH SHORT-TERM PERFORMANCE MEASURES

ABSTRACT. Solar energy utilization has been triggered by advances in new technology to reduce the cost of photovoltaic (PV) panels with an increase of efficiency. To improve the energy production quality, it is necessary to undergo the PV panels to characterization both in the indoor and outdoor scenarios; these latter characterizations generally require all seasons-based measurements. Therefore, it is essential to find models for characterizing PV panels in terms of energy production but also production and operating mode tolerance. The paper illustrates the findings of global research dedicated to PV panels ageing and their impact on energy production in the years. At first, an in-depth analysis of the ageing mechanisms affecting II and III generations' PV panels has been presented when exposed to atmospheric agents. Afterwards, the PV panels' characterization, conducted in a short time (i.e. a total of seven days), has been reported, performing outdoor measurements in conjunction with an electronic calibrator able to measure currents and voltages. The MPPT (Maximum Power Point Tracker) device is the core instrumentation of the employed measurement system. Obtained results are convincing since they have been compared with simultaneous measurements of PV panels located in the same place. © 2021, International Journal Of Renewable Energy Research. All rights reserved.

Visconti, P., de Fazio, R., Cafagna, D., Velázquez, R., & Lay-Ekuakille, A. (2021). A Survey on Ageing Mechanisms in II and III- Generation PV Modules: Accurate Matrix-Method Based Energy Prediction Through Short-Term Performance Measures. *International Journal of Renewable Energy Research*, 11(1), 178-194. Article.

Ramiro Velázquez Guerrero

SNI Nivel I

AN EFFICIENT POINT-MATCHING METHOD BASED ON MULTIPLE GEOMETRICAL HYPOTHESES

ABSTRACT. Point matching in multiple images is an open problem in computer vision because of the numerous geometric transformations and photometric conditions that a pixel or point might exhibit in the set of images. Over the last two decades, different techniques have been proposed to address this problem. The most relevant are those that explore the analysis of invariant features. Nonetheless, their main limitation is that invariant analysis all alone cannot reduce false alarms. This paper introduces an efficient point-matching method for two and three views, based on the combined use of two techniques: (1) the correspondence analysis extracted from the similarity of invariant features and (2) the integration of multiple partial solutions obtained from 2D and 3D geometry. The main strength and novelty of this method is the determination of the point-to-point geometric correspondence through the intersection of multiple geometrical hypotheses weighted by the maximum likelihood estimation sample consensus (MLESAC) algorithm. The proposal not only extends the methods based on invariant descriptors but also generalizes the correspondence problem to a perspective projection model in multiple views. The developed method has been evaluated on three types of image sequences: outdoor, indoor, and industrial. Our developed strategy discards most of the wrong matches and achieves remarkable F-scores of 97%, 87%, and 97% for the outdoor, indoor, and industrial sequences, respectively. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

Carrasco, M., Mery, D., Concha, A., Velázquez, R., De Fazio, R., & Visconti, P. (2021). An efficient point-matching method based on multiple geometrical hypotheses. *Electronics* (Switzerland), 10(3), 1-20. Art. 246. doi: 10.3390/electronics10030246. Article.

Ramiro Velázquez Guerrero

SNI Nivel I

AN OVERVIEW OF TECHNOLOGIES AND DEVICES AGAINST COVID-19 PANDEMIC DIFFUSION: VIRUS DETECTION AND MONITORING SOLUTIONS

ABSTRACT. The year 2020 will remain in the history for the diffusion of the COVID-19 virus, originating a pandemic on a world scale with over a million

deaths. From the onset of the pandemic, the scientific community has made numerous efforts to design systems to detect the infected subjects in ever-faster times, allowing both to intervene on them, to avoid dangerous complications, and to contain the pandemic spreading. In this paper, we present an overview of different innovative technologies and devices fielded against the SARS-CoV-2 virus. The various technologies applicable to the rapid and reliable detection of the COVID-19 virus have been explored. Specifically, several magnetic, electrochemical, and plasmonic biosensors have been proposed in the scientific literature, as an alternative to nucleic acid-based real-time reverse transcription Polymerase Chain Reaction (PCR) (RT-qPCR) assays, overcoming the limitations featuring this typology of tests (the need for expensive instruments and reagents, as well as of specialized staff, and their reliability). Furthermore, we investigated the IoT solutions and devices, reported on the market and in the scientific literature, to contain the pandemic spreading, by avoiding the contagion, acquiring the parameters of suspected users, and monitoring them during the quarantine period. © 2021. Authors.

De Fazio, R., Sponziello, A., Cafagna, D., Velázquez, R., & Visconti, P. (2021). An overview of technologies and devices against COVID-19 pandemic diffusion: virus detection and monitoring solutions. *International Journal on Smart Sensing and Intelligent Systems*, 14(1), 1-28. doi: 10.21307/IJSSIS-2021-003. Article.

Ramiro Velázquez Guerrero

SNI Nivel I

AN OVERVIEW OF WEARABLE PIEZORESISTIVE AND INERTIAL SENSORS FOR RESPIRATION RATE MONITORING

ABSTRACT. The demand for wearable devices to measure respiratory activity is constantly growing, finding applications in a wide range of scenarios (e.g., clinical environments and workplaces, out-doors for monitoring sports activities, etc.). Particularly, the respiration rate (RR) is a vital parameter since it indicates serious illness (e.g., pneumonia, emphysema, pulmonary embolism, etc.). Therefore, several solutions have been presented in the scientific literature and on the market to make RR monitoring simple, accurate, reliable and noninvasive. Among the different transduction methods, the piezoresistive and inertial ones satisfactorily meet the requirements for smart wearable devices since unobtrusive, lightweight and easy to integrate. Hence, this review paper focuses on innovative wearable

devices, detection strategies and algorithms that exploit piezoresistive or inertial sensors to monitor the breathing parameters. At first, this paper presents a comprehensive overview of innovative piezoresistive wearable devices for measuring user's respiratory variables. Later, a survey of novel piezoresistive textiles to develop wearable devices for detecting breathing movements is reported. Afterwards, the state-of-art about wearable devices to monitor the respiratory parameters, based on inertial sensors (i.e., accelerometers and gyroscopes), is presented for detecting dysfunctions or pathologies in a non-invasive and accurate way. In this field, several processing tools are employed to extract the respiratory parameters from inertial data; therefore, an overview of algorithms and methods to determine the respiratory rate from acceleration data is provided. Finally, comparative analysis for all the covered topics are reported, providing useful insights to develop the next generation of wearable sensors for monitoring respiratory parameters. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

De Fazio, R., Stabile, M., De Vittorio, M., Velázquez, R., & Visconti, P. (2021). An overview of wearable piezoresistive and inertial sensors for respiration rate monitoring. *Electronics* (Switzerland), 10(17). Art. 2178. doi: 10.3390/electronics10172178. Review.

Ramiro Velázquez Guerrero

SNI Nivel I

Carolina del Valle Soto

Investigadora Titular D, SNI Nivel I

CONTACTLESS ENVIRONMENT MAP CONSTRUCTION WITH ULTRASONIC SENSORS

ABSTRACT. This paper presents a contactless environment mapping system for autonomous navigation of mobile robots. Based on ultrasonic sensing, the proposed system obtains reliable and accurate maps of unknown environments without the need of physical contact and regardless of the scene's illumination. These maps include the location of obstacles and objects in the environment; therefore, they can be used for autonomous navigation and trajectory planning of mobile robots. This paper introduces the design, implementation, and preliminary results showing feasibility of the proposed system. © 2020 IEEE.

Romo, M., Velázquez, R., Del-Valle-Soto, C., & Garzon-Castro, C. L. (2020). Contactless environment map construction with ultrasonic sensors. 2020 IEEE ANDESCON, ANDESCON 2020, Quito, Ecuador. IEEE ANDESCON, 2020. Art. 9271973. doi: 10.1109/ANDESCON50619.2020.9271973. Conference Paper.

Ramiro Velázquez Guerrero

SNI Nivel I

Mario Acevedo Alvarado

SNI Nivel I

María Teresa Orvañanos Guerrero

Profesora investigadora

DESIGN AND CHARACTERIZATION OF A MINIATURE BIO-INSPIRED MOBILE ROBOT

ABSTRACT. This paper presents the design, implementation, and characterization of a miniature crab-like walking robot. The first prototype developed is a four-legged servomotor actuated machine that exhibits compact dimensions, low mass, and is capable of overcoming obstacles and moving on irregular terrain and confined spaces. Its bio-inspired design ensures the compliance of its locomotion mechanism even in the presence of external disturbances. The mechanical design, the implementation of the prototype, and its electronic control approach are first discussed. Next, a kinematic analysis characterizing its motion is presented. The aim of this device is to serve as an educational supporting platform for understanding robot kinematics and legged locomotion. © 2021 IEEE.

Velazquez, R., Garzon-Castro, C. L., Acevedo, M., Orvanos-Guerrero, M. T., & Ghavifekr, A. A. (2021). Design and Characterization of a Miniature Bio-Inspired Mobile Robot. 12th International Symposium on Advanced Topics in Electrical Engineering. ATEE, 2021. Art. 9425096. doi: 10.1109/ATEE52255.2021.9425096. Conference Paper.

Ramiro Velázquez Guerrero

SNI Nivel I

DETECTION OF RIVER FLOW SLOW-DOWN THROUGH SENSING SYSTEM AND QUASI-REAL TIME IMAGING

ABSTRACT. Flow slow-down in rivers and artificial canals is a basic aspect to be monitored and kept strictly under control. Flow slow-downs can become a major concern in the event of extreme phenomena. The paper illustrates an advanced image processing method that uses particle tracking velocimetry in conjunction with a monadic approach to better characterize water flow in the presence of waste or debris that block normal water flow within a river. An high-speed camera installed beneath a bridge takes periodic images of the water flow. The measured water level and the images taken by the camera are sent to a central system in real-time. Results demonstrate the capability of the proposed method to accurately detect the presence of debris from the measured water flow. © 2021 Elsevier Ltd.

Lay-Ekuakille, A., Ugwiri, M. A., Telesca, V., Velazquez, R., Passarella, G., & Maggi, S. (2021). Detection of river flow slow-down through sensing system and quasi-real time imaging. *Flow Measurement and Instrumentation*, 81. Art. 102042. doi: 10.1016/j.flowmeasinst.2021.102042. Article.

Ramiro Velázquez Guerrero

SNI Nivel I

DEVELOPMENT OF A SELF-POWERED PIEZO-RESISTIVE SMART INSOLE EQUIPPED WITH LOW-POWER BLE CONNECTIVITY FOR REMOTE GAIT MONITORING

ABSTRACT. The evolution of low power electronics and the availability of new smart materials are opening new frontiers to develop wearable systems for medical applications, lifestyle monitoring, and performance detection. This paper presents the development and realization of a novel smart insole for monitoring the plantar pressure distribution and gait parameters; indeed, it includes a piezoresistive sensing matrix based on a Velostat layer for transducing applied pressure into an electric signal. At first, an accurate and complete characterization of Velostat-based pressure sensors is reported as a function of sizes, support material, and pressure trend. The realization and testing of a low-cost and reliable piezoresistive sensing matrix based on a sandwich structure are discussed. This last is interfaced with a low power conditioning and processing section based on an Arduino Lilypad board and an analog multiplexer for acquiring the pressure data. The insole includes a 3-axis capacitive accelerometer for detecting the gait parameters (swing time and stance phase time) featuring the walking. A Bluetooth Low Energy (BLE) 5.0 module is included for transmitting in real-time the acquired data toward a PC, tablet or smartphone, for displaying and processing them using a custom Processing® application. Moreover, the smart insole is equipped with a piezo-electric harvesting section for scavenging energy from walking. The onfield tests indicate that for a walking speed higher than 1 ms⁻¹, the device's power requirements (i.e., P = 5.84 mW) was fulfilled. However, more than 9 days of autonomy are guaranteed by the integrated 380-mAh Lipo battery in the total absence of energy contributions from the harvesting section. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

De Fazio, R., Perrone, E., Velázquez, R., De Vittorio, M., & Visconti, P. (2021). Development of a self-powered piezo-resistive smart insole equipped with low-power ble connectivity for remote gait monitoring. *Sensors*, 21(13). Art. 4539 doi: 10.3390/s21134539. Article.

Ramiro Velázquez Guerrero

SNI Nivel I

Claudia Nallely Sánchez Gómez

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SNI Nivel I

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Profesora investigadora

EFFICIENT BALANCING OPTIMIZATION OF A SIMPLIFIED SLIDER-CRANK MECHANISM

ABSTRACT. High-speed link motion produces reactions that are transmitted to the base of mechanisms causing undesired effects such as vibrations, wear, and fatigue. These problems can be reduced or even better eliminated if a balancing technique is performed. To this day, most of the papers in the literature dealing with the balancing of mechanisms obtain the balancing conditions with the use of Cartesian coordinates, which result in complex equations that involve trigonometric functions difficult to simplify. This work presents the balancing optimization of a simplified slider-crank mechanism by obtaining its balancing conditions with the use of natural coordinates. Numerical results show the effectiveness of this approach: the Shaking Moment and the Shaking Force dynamic reactions can be decreased in 97.76% and 94.58%, respectively. © 2020 IEEE.

Orvanos-Guerrero, M. T., Acevedo, M., Sanchez, C. N., Ivan Giannoccaro, N., Visconti, P., & Velazquez, R. (2020). Efficient balancing optimization of a simplified slider-crank mechanism. 2020 IEEE ANDESCON, ANDESCON 2020, Quito, Ecuador. IEEE ANDESCON, 2020. Art. 9272109. doi: 10.1109/ANDESCON50619.2020.9272109. Conference Paper.

Ramiro Velázquez Guerrero

SNI Nivel I

Carolina del Valle Soto

Investigadora Titular D, SNI Nivel I

Leonardo Jesús Valdivia Parga

SNI Nivel Candidato

ENERGY-EFFICIENCY MODEL FOR A SMART BUILDING: A REAL APPLICATION

ABSTRACT. One of the most significant benefits of the Internet of Things (IoT) is its efficiency. Many companies use this system to automate business and manufacturing processes, remotely monitor and control operations, optimize supply chains, and conserve resources. Smart devices agglom-

erate a huge amount of IoT data that needs to be analyzed in real-time. Most of the sensors are in remote areas or difficult for people to access, for this reason, it is necessary to analyze in detail the type of technology used as well as the installation site to optimize the use of energy. This work presents a real application of IoT in the monitoring of a building, in addition, an algorithm is used that optimizes the energy used, increasing the battery lifetime. In this way, it is possible to have an intelligent and energy-saving system. This work analyzes the main wireless technologies such as Zigbee, WiFi and LoRa in order to propose the ideal routing protocol depending on performance metrics in a building on a university campus. © 2020 IEEE.

Del-Valle-Soto, C., Velazquez, R., Garzon-Castro, C. L., & Valdivia, L. J. (2020). Energy-efficiency model for a smart building: A real application. 2020 IEEE ANDESCON, ANDESCON 2020, Quito, Ecuador. IEEE ANDESCON, 2020. Art. 9271989. doi: 10.1109/ANDESCON50619.2020.9271989. Conference Paper.

Ramiro Velázquez Guerrero

SNI Nivel I

GENERATION OF GAIT EVENTS WITH A FSR BASED CANE HANDLE

ABSTRACT. Gait analysis has many applications, and specifically can improve the control of prosthesis, exoskeletons, or Functional Electrical Stimulation systems. The use of canes is common to complement the assistance in these cases, and the synergy between upper and lower limbs can be exploited to obtain information about the gait. This is interesting especially in the case of unilateral assistance, for instance in the case of one side lower limb exoskeletons. If the cane is instrumented, it can hold sensors that otherwise should be attached to the body of the impaired user. This can ease the use of the assistive system in daily life as well as its acceptance. Moreover, Force Sensing Resistors (FSRs) are common in gait phase detection systems, and force sensors are also common in user intention detection. Therefore, a cane that incorporates FSRs on the handle can take advantage from the direct interface with the human and provide valuable information to implement real-time control. This is done in this paper, and the results confirm that many events are detected from variables derived from the readings of the FSRs that provide rich information about gait. However, a large inter-subject variability points to the need of tailored control systems. © 2020 by the authors. Licensee MDPI, Basel, Switzerland.

Trujillo-León, A., De Guzmán-Manzano, A., Velázquez, R., & Vidal-Verdú, F. (2021). Generation of gait events with a fsr based cane handle. *Sensors*, 21(16). Art. 5632. doi: 10.3390/s21165632. Article.

Ramiro Velázquez Guerrero

SNI Nivel I

HIGH-PERFORMANCE AES-128 ALGORITHM IMPLEMENTATION BY FPGA-BASED SOC FOR 5G COMMUNICATIONS

ABSTRACT. In this research work, a fast and light-weight AES-128 cypher based on the Xilinx ZCU102 FPGA board is presented, suitable for 5G communications. In particular, both encryption and decryption algorithms have been developed using a pipelined approach, so enabling the simultaneous processing of the rounds on multiple data packets at each clock cycle. Both the encryption and decryption systems support an operative frequency up to 220 MHz, reaching 28.16 Gbit/s maximum data throughput; besides, the encryption and decryption phases last both only ten clock periods. To guarantee the interoperability of the developed encryption/decryption system with the other sections of the 5G communication apparatus, synchronization and control signals have been integrated. The encryption system uses only 1631 CLBs, whereas the decryption one only 3464 CLBs, ascribable, mainly, to the Inverse Mix Columns step. The developed cypher shows higher efficiency (8.63 Mbps/slice) than similar solutions present in literature. © 2021 Institute of Advanced Engineering and Science. All rights reserved.

Visconti, P., Velazquez, R., Capoccia, S., & De Fazio, R. (2021). High-performance AES-128 algorithm implementation by FPGA-based SoC for 5G communications. *International Journal of Electrical and Computer Engineering*, 11(5), 4221-4232. doi: 10.11591/ijece.v11i5.pp4221-4232. Article.

Ramiro Velázquez Guerrero

SNI Nivel I

IMAGE-BASED AUTOMATED WIDTH MEASUREMENT OF SURFACE CRACKING

ABSTRACT. The detection of cracks is an important monitoring task in civil engineering infrastructure devoted to ensuring durability, structural safety, and integrity. It has been traditionally performed by visual inspection, and the measurement of crack width has been manually obtained with a crackwidth comparator gauge (CWCG). Unfortunately, this technique is time-consuming, suffers from subjective judgement, and is error-prone due to the difficulty of ensuring a correct spatial measurement as the CWCG may not be correctly positioned in accordance with the crack orientation. Although algorithms for automatic crack detection have been developed, most of them have specifically focused on solving the segmentation problem through Deep Learning techniques failing to address the underlying problem: crack width

evaluation, which is critical for the assessment of civil structures. This paper proposes a novel automated method for surface cracking width measurement based on digital image processing techniques. Our proposal consists of three stages: anisotropic smoothing, segmentation, and stabilized central points by k-means adjustment and allows the characterization of both crack width and curvature-related orientation. The method is validated by assessing the surface cracking of fiber-reinforced earthen construction materials. The preliminary results show that the proposal is robust, efficient, and highly accurate at estimating crack width in digital images. The method effectively discards false cracks and detects real ones as small as 0.15 mm width regardless of the lighting conditions. © 2021 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 (<https://creativecommons.org/licenses/by/4.0/>).

Carrasco, M., Araya-Letelier, G., Velázquez, R., & Visconti, P. (2021). Image-based automated width measurement of surface cracking. *Sensors*, 21(22). Art. 7534 doi: 10.3390/s21227534. Article.

Ramiro Velázquez Guerrero

SNI Nivel I

Carolina del Valle Soto

Investigadora Titular D, SNI Nivel I

INTELLIGENT PI CONTROLLER FOR MICROALGAE GROWTH IN A CLOSED PHOTOBIOREACTOR

ABSTRACT. One of the microorganisms used in the industry to generate high value products is the microalga. Due to its nonlinear dynamics and variation in time, bioprocesses that involve the use of microalgae pose challenges in modeling, controlling, and increasing their production. Normally, at the laboratory level, closed cultures of microalgae are carried out in photobioreactors. To produce biomass, the culture conditions can be controlled using a photobioreactor. This paper describes the design of an intelligent Proportional-Integral controller applied in a continuous culture of *Chlorella vulgaris* microalga, where the controlled variable is the dilution rate $D(t)$. This controller is characterized by formulating the dynamics of the system with an ultra-local model. In this ultra-local model, both the uncertainties of the system dynamics and the disturbances are handled in one unified way. The performance of the intelligent Proportional-Integral controller was tested at simulation level using Matlab EnvironmentTM. In this research, the accomplishment of the controller was contemplated against disturbances, under nom-

inal conditions and front variation of parameters. The simulations showed that the intelligent Proportional-Integral controller ensures excellent reference tracking capability. Finally, it is important to highlight the robustness of the strategy. © 2020 IEEE.

Garzon-Castro, C. L., Cardona, M., Velazquez, R., & Del-Valle-Soto, C. (2020). Intelligent PI controller for microalgae growth in a closed photobioreactor. 2020 IEEE ANDESCON, ANDESCON 2020, Quito, Ecuador. IEEE ANDESCON, 2020. Art. 9272007. doi: 10.1109/ANDESCON50619.2020.9272007. Conference Paper.

Ramiro Velázquez Guerrero

SNI Nivel I

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LINEAR AND NONLINEAR CONTROL APPROACHES FOR THE CART INVERTED PENDULUM PROBLEM

ABSTRACT. This paper presents a complete review of the cart inverted pendulum (CIP) problem. The design, modeling, and control of such system as well as the implementation of a mechatronic prototype are herein presented. Several linear and nonlinear approaches such as PD, PID, and adaptive control are proposed to stabilize the system. Both theoretical and experimental performances are compared to evaluate the precision of the mathematical formulations. The aim of this study is to serve as a tutorial or supporting material for understanding the dynamics governing this system together with the potential control strategies. © 2021 IEEE.

Preza, E., Velazquez, R., Macías-Quijas, R., Hernandez, E., & Visconti, P. (2021). Linear and Nonlinear Control Approaches for the Cart Inverted Pendulum Problem. 12th International Symposium on Advanced Topics in Electrical Engineering. ATEE, 2021. Art. 9425095. doi: 10.1109/ATEE52255.2021.9425095. Conference Paper.

Ramiro Velázquez Guerrero

SNI Nivel I

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MOBILITY OF BLIND PEOPLE USING THE SMARTPHONE'S GPS AND A WEARABLE TACTILE DISPLAY

ABSTRACT. This paper presents a novel wearable system devoted to assist the mobility of blind and

visually impaired people in urban environments with the simple use of a smartphone and tactile feedback. The system exploits the positioning data provided by the smartphone's GPS sensor to locate in real-time the user in the environment and to determine the directions to a destination. The resulting navigational directions are encoded as vibrations and conveyed to the user via an on-shoe tactile display. To validate the pertinence of the proposed system, two experiments were conducted with test users. The first one involved a group of 20 voluntary normally sighted subjects that were requested to recognize the navigational instructions displayed by the tactile-foot device. The results show high recognition rates for the task. The second experiment consisted of guiding two blind voluntary subjects along public urban spaces to target destinations. Results show that the task was successfully accomplished and suggest that the system enhances independent safe navigation of visually impaired and blind people. Moreover, results show the potentials of smartphones and tactile-foot devices in assistive technology.

Velazquez-Guerrero, R., Pissaloux, E., Del-Valle-Soto, C., Carrasco-Zambrano, M. A., Mendoza-Andrade, A., & Varona-Salazar, J. (2021). Mobility of blind people using the smartphone's GPS and a wearable tactile display. *DYNA*, 96(1), 98-104. doi: 10.6036/9635. Article.

Ramiro Velázquez Guerrero

SNI Nivel I

SENSOR-BASED MOBILE ROBOT FOR HARSH ENVIRONMENTS: FUNCTIONALITIES, ENERGY CONSUMPTION ANALYSIS AND CHARACTERISATION

ABSTRACT. Mobile robots and rovers play an important role in many industrial applications. Under certain constraints, they are suitable in harsh environments and conditions in which protracted human activity is not safe or permitted. In many circumstances, mechanical aspects and electrical consumption need to be optimized for autonomous and wheeled mobile robots. The paper illustrates the design of a semi-custom wheeled mobile robot with high-efficiency mono- or polycrystalline photovoltaic panel on the roof that supports the lithium ion batteries during particular tasks (e.g. navigating rough terrain, obstacles or steep paths) to extend the robot's autonomy. An electronic controller was designed, and data acquisition related to power consumption performed using a specific experimental setup. The robot can detect parameters such as temperature, humidity, concentrations of toxic gas species and the presence of flames, making it particularly suitable for contaminated

environments or industrial plants. For this aim, the mobile robot was equipped with a wide range of commercial sensors and a Global Positioning System receiver to track its position. In addition, using an HC-06 Bluetooth transceiver, the robot receives commands and instructions, and sends the acquired data to the developed IoT smart-phone application, where they are displayed to be analysed by user. © 2021 International Measurement Confederation (IMEKO). All rights reserved.

Fazio, R. D., Katamba, D. M., Ekuakille, A. L., Ferreira, M. J., Kidimboko, S., Giannoccaro, N. I., Velazquez, R., Visconti, P. (2021). Sensor-based mobile robot for harsh environments: Functionalities, energy consumption analysis and characterisation. *Acta IMEKO*, 10(2), 209-219. doi: 10.21014/acta_imeko.v10i2.907. Article.

Ramiro Velázquez Guerrero

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SOLAR-POWERED DEEP LEARNING-BASED RECOGNITION SYSTEM OF DAILY USED OBJECTS AND HUMAN FACES FOR ASSISTANCE OF THE VISUALLY IMPAIRED

ABSTRACT. This paper introduces a novel low-cost solar-powered wearable assistive technology (AT) device, whose aim is to provide continuous, real-time object recognition to ease the finding of the objects for visually impaired (VI) people in daily life. The system consists of three major components: a miniature low-cost camera, a system on module (SoM) computing unit, and an ultrasonic sensor. The first is worn on the user's eyeglasses and acquires real-time video of the nearby space. The second is worn as a belt and runs deep learning-based methods and spatial algorithms which process the video coming from the camera performing objects' detection and recognition. The third assists on positioning the objects found in the surrounding space. The developed device provides audible descriptive sentences as feedback to the user involving the objects recognized and their position referenced to the user gaze. After a proper power consumption analysis, a wearable solar harvesting system, integrated with the developed AT device, has been designed and tested to extend the energy autonomy in the different operating modes and scenarios. Experimental results obtained with the developed low-cost AT device have demonstrated an accurate and reliable real-

time object identification with an 86% correct recognition rate and 215 ms average time interval (in case of high-speed SoM operating mode) for the image processing. The proposed system is capable of recognizing the 91 objects offered by the Microsoft Common Objects in Context (COCO) dataset plus several custom objects and human faces. In addition, a simple and scalable methodology for using image datasets and training of Convolutional Neural Networks (CNNs) is introduced to add objects to the system and increase its repertory. It is also demonstrated that comprehensive trainings involving 100 images per targeted object achieve 89% recognition rates, while fast trainings with only 12 images achieve acceptable recognition rates of 55%. © 2020 by the authors.

Calabrese, B., Velázquez, R., Del-Valle-Soto, C., & De Fazio R., Giannoccaro N.I., Visconti P. (2020). Solar-powered deep learning-based recognition system of daily used objects and human faces for assistance of the visually impaired. *Energies*, 13(22). Art. 6104. doi: 10.3390/en13226104. Article.

Ramiro Velázquez Guerrero

SNI Nivel I

WEARABLE DEVICES AND IOT APPLICATIONS FOR SYMPTOM DETECTION, INFECTION TRACKING, AND DIFFUSION CONTAINMENT OF THE COVID-19 PANDEMIC: A SURVEY

ABSTRACT. Until a safe and effective vaccine to fight the SARS-CoV-2 virus is developed and available for the global population, preventive measures, such as wearable tracking and monitoring systems supported by Internet of Things (IoT) infrastructures, are valuable tools for containing the pandemic. In this review paper we analyze innovative wearable systems for limiting the virus spread, early detection of the first symptoms of the coronavirus disease COVID-19 infection, and remote monitoring of the health conditions of infected patients during the quarantine. The attention is focused on systems allowing quick user screening through ready-to-use hardware and software components. Such sensor-based systems monitor the principal vital signs, detect symptoms related to COVID-19 early, and alert patients and medical staff. Novel wearable devices for complying with social distancing rules and limiting interpersonal contagion (such as smart masks) are investigated and analyzed. In addition, an overview of implantable devices for monitoring the effects of COVID-19 on the cardiovascular system is presented. Then we report an overview of tracing strategies and technologies for containing the COVID-19 pandemic based on

IoT technologies, wearable devices, and cloud computing. In detail, we demonstrate the potential of radio frequency based signal technology, including Bluetooth Low Energy (BLE), Wi-Fi, and radio frequency identification (RFID), often combined with Apps and cloud technology. Finally, critical analysis and comparisons of the different discussed solutions are presented, highlighting their potential and providing new insights for developing innovative tools for facing future pandemics. © 2021, Zhejiang University Press.

De Fazio, R., Giannoccaro, N. I., Carrasco, M., Velazquez, R., & Visconti, P. (2021). Wearable devices and IoT applications for symptom detection, infection tracking, and diffusion containment of the COVID-19 pandemic: a survey. *Frontiers of Information Technology and Electronic Engineering*, 22(11), 1413-1442. doi: 10.1631/FITEE.2100085. Review.



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IN SEARCH OF "THAT ARCHIMEDEAN POINT": THE DEVELOPMENT OF SELFHOOD IN KIERKEGAARD'S JOURNAL OF GILLELEJE

ABSTRACT. This article offers a philosophical account of the so-called journal of Gilleleje. I would like to argue that in this text from 1835 one can trace the early philosophical musings of Kierkegaard on the existential question of the discovery of the self and the development of selfhood, one of the main motifs in the authorship of the Dane. Additionally, I discuss the literary trends of the 1830s in Golden Age Denmark, particularly the boom of the Danish short novel and Heiberg's admiration of Goethe, analyzing in what way this local context impacted Kierkegaard's ideas in the journal of Gilleleje. © 2021 Walter de Gruyter GmbH, Berlin/Boston.

Bravo, N. (2021). In search of "that Archimedean point": The development of selfhood in Kierkegaard's journal of gilleleje. *Kierkegaard Studies*, 26(1). doi: 10.1515/ki-erke-2021-0002. Review.

Federico Nassim Bravo Jordán

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KIERKEGAARD AND THE MASTER-THIEF PROJECT (1834-1835): THE REBEL OUTCAST AND THE ESTABLISHED ORDER

[KIERKEGAARD Y EL PROYECTO SOBRE EL LADRÓN MAESTRO (1834-1835): EL REBELDE MARGINADO FRENTE AL ORDEN ESTABLECIDO]

ABSTRACT. In the years 1834 and 1835, Kierkegaard, still a 21-year-old student at the University of Copenhagen, became interested in the mythical character known as the master-thief. He then decided to work on a drama about this character and his struggle against the established order. With this in mind, the paper has two main objectives. First, to offer a complete account of the so-called master-thief project. Kierkegaard's notes on the master-thief have remained in a relative obscurity. This paper aims at exposing this little-known work of the Danish thinker to the Spanish-speaking reader. Second, to analyze the philosophical question raised in the master thief project, that is, the issue about the relationship of the rebel and marginalized individual with the established order. © 2020 Universidad del Norte. All rights reserved.

Bravo, N. (2020). Kierkegaard and the master-thief project (1834-1835): The rebel outcast and the established order [Kierkegaard y el proyecto sobre el ladrón maestro (1834-1835): El rebelde marginado frente al orden establecido]. *Eidos*, 32, 281-308. doi: 10.14482/eidos.32.198.9. Article.

Federico Nassim Bravo Jordán

SNI Nivel Candidato

THE SEARCH FOR THE SELF AND THE DEVELOPMENT OF PERSONHOOD IN SØREN KIERKEGAARD'S "JOURNAL OF GILLELEJE"

[LA BÚSQUEDA DEL YO Y EL DESARROLLO DE LA PERSONALIDAD EN EL "DIARIO DE GILLELEJE" DE SØREN KIERKEGAARD]

ABSTRACT. In the following article I offer an analysis of the so-called "journal of Gilleleje" by Danish philosopher Søren Kierkegaard. I would like to argue that in this early writing of 1836, a piece with a distinct literary tone, it is possible to observe young Kierkegaard's first philosophical insights on the existential question about the discovery of the self and the development of personhood, one of the key topics in the Dane's writings. The journal concludes with the exposition of a central concept in Kierkegaard's thought: Subjective truth. © 2021 Pontificio Seminario Mayor San Rafael. All rights reserved.

Bravo, N. (2021). The search for the Self and the development of personhood in Søren Kierkegaard's "Journal of Gilleleje" [La búsqueda del Yo y el desarrollo de la personalidad en el "diario de Gilleleje" de Søren Kierkegaard]. *Veritas*, 48, 57-78. doi: 10.4067/S0718-92732021000100057. Article.

Claudio César Calabrese

Investigador Titular D, SNI Nivel I

Ethel Beatriz Junco de Calabrese

Investigadora Titular D, SNI Nivel I

TEXT AND MYSTICAL VISION IN SAINT AUGUSTINE AND SAINT HILDEGARD

[TEXTO Y VISIÓN MÍSTICA EN SAN AGUSTÍN Y EN SANTA HILDEGARDA]

ABSTRACT. The prophetic and visionary framework of Saint Hildegard's text can be understood in the light of Augustinian reflection as a continuity of a tradition rather than a simple textual presence. We will try to prove, then, this double hypothesis: on the one hand, that the prophetic experience of Saint Hildegard can be followed according to the parameters considered by Saint Augustine; and, on the other hand, in evident dependence of the previous reason: that the data "of this world" as a prison (not the cosmos but the state of disorder and harassment of necessity) can only be fully understood through a movement of the spirit upward or toward the deep, according to the internal logic of this movement.

Calabrese, C. C. & Junco, E. (2018). Text and mystical vision in Saint Augustine and Saint Hildegard [Texto y visión mística en san agustín y en santa hildegarda]. *Espíritu*, 67(155), 173-199. Article.

Claudio César Calabrese

Investigador Titular D, SNI Nivel I

THE APPROPRIATION OF THE CLASSICAL INHERITANCE AS AN INSTRUMENT TO UNDERSTAND GOD. CLEMENT OF ALEXANDRIA, STROMATA V (89,1-100,4)

ABSTRACT. From an interpretative approach, we present the reading results of Stromata V (89,1-100,4) of Clement of Alexandria, in order to consider classical inheritance as an instrument to deepen understanding of God. We are interested in showing the correlation between the Greek-Jewish sequence and the biblical texts, and at the same time, to propose continuity—not without difficulties—between the peculiar notion of the divine of the Hellenic tradition and the uncreated conception of nature, which implies the gradual identification of the Greek notions of physis and theós. According to Clement's method of reading, we make the analysis of the Greek texts clarified from the Old Testament and vice versa, to conclude in his personal conviction, within the framework of primitive Christianity, that Christians are heirs of all openness of God to the world. To reach this conclusion, Clement argues, from a Platonic perspective, with a view that is both anthropological (man can progressively assimilate to God, from his natural disposition to the virtuous life) and Christological ("everything comes from the only Master"). For this reason, in the interpretation of our author, revelation has redefined human history also from a metaphysical perspective, since Christ has incorporated humanity into history, in a completely new sense, as he providentially founds pagan culture. In Stromata, this is possible, because from the beginning, an artistic way of interpreting man in his relationship with divinity is manifested: the mythical and philosophical knowledge of the Greeks about God had been, for this reason, also theological, insofar as it was manifest in the cosmos. This hermeneutical model will be shown, from the beginning, in revision and in crisis, because the person of Christ may be hidden, from the perspective of our understanding, by the necessary cosmic reference. © 2021. All Rights Reserved.

Calabrese, C. C. (2021). The Appropriation of the Classical Inheritance as an Instrument to Understand God. Clement of Alexandria, Stromata V (89,1-100,4). *Theologica Xaveriana*, 71, 1-26. doi: 10.11144/javeriana.tx71.hcid. Article.

Claudio César Calabrese

Investigador Titular D, SNI Nivel I

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THE MYTH OF DANAE IN THE CONFESSIONS OF SAINT AUGUSTINE

[EL MITO DE DÁNAE EN LAS CONFESIONES DE SAN AGUSTÍN]

ABSTRACT. The links between literature and revelation are changing throughout the intellectual life of Saint Augustine: from the conviction of the centrality of the Liberal Arts to discern the meanings of Revelation, to its abandonment, from Confessions onwards, when he focused his efforts in the development of biblical exegesis. In this context of distance from classical culture, we place his interpretation, with clear rationalist overtones, of the myth of Danae and, closely related to it, a critique of the Roman educational system of Late Antiquity and a reflection on the scarce control of the reason over passions. © 2021, Universidad del Zulia. All rights reserved.

Calabrese, C. & Junco, E. B. (2021). The myth of danae in the confessions of saint augustine [El mito de danae en las confesiones de san agustín]. *Revista de Filosofía* (Venezuela), 38(97), 213-230. doi: 10.5281/zenodo.4876742. Article.

Claudio César Calabrese

Investigador Titular D, SNI Nivel I

Ethel Beatriz Junco de Calabrese

Investigadora Titular D, SNI Nivel I

THE NEOPLATONIC THEOLOGY IN DE DOCTRINA CHRISTIANA. DISCOVER AND COMMUNICATE GOD IN EXEGESIS

[LA TEOLOGÍA NEOPLATÓNICA EN DE DOCTRINA CHRISTIANA. DESCUBRIR Y COMUNICAR A DIOS EN LA EXÉGESIS]

ABSTRACT. In our paper we present the work De doctrina christiana as the theological culmination, in an exegetical key, of the Neoplatonic vision of the world, which Saint Augustine expresses in the dialogues of Cassiciaco. We explore how the tradition begun by Plato, which lays the foundations of the intellectual and linguistic conditions to base a discourse on God, although in the realm of immanent physis, now illuminates a transcendent and ineffable understanding of God. Saint Augustine took a fundamental step with respect to De dialectica and De magistro, since, starting from the semiotics of the first and the theory of

knowledge of the second, he established a philosophy of language as a way of sustaining the scope of biblical exegesis. The Augustinian experience of reading Scripture, which offers praecepta to distinguish the literal sense from the figurative and tools to understand the second, seeks to discover and communicate God. © 2021 Alexandru Ioan Cuza University of Iasi. All rights reserved.

Calabrese, C. C. & Junco, E. (2021). The neoplatonic theology in de doctrina christiana. Discover and communicate God in exegesis [Teologia neoplatonică în De doctrina christiana. A descoperi și a comunica pe Dumnezeu în exegeză] [LA TEOLOGÍA NEOPLATÓNICA EN DE DOCTRINA CHRISTIANA. DESCUBRIR Y COMUNICAR A DIOS EN LA EXÉGESIS]. *Classica et Christiana*, 16, 47-66. Review.

María Teresa Enríquez Gómez

Investigadora Asociada, Profesora investigadora

FINALITY, COMMAND AND ACTION

[FINALIDAD, IMPERIO Y ACCIÓN]

ABSTRACT. The present article constitutes an attempt to show how the concept of imperium (command) in Thomas Aquinas, read in light of authors such as Alejandro Vigo and Harry Frankfurt, contributes to the understanding of the action in the context of the human life. It is when the free action is considered in light of the imperium that we recognize it as something more than itself: more than the effect of an impulse, more than a corporal movement, more than an isolated act from a sole operative principle. Such something more means that an action can contain, in its apparent meaningless reality, the very purpose of a life. © 2020, Editorial Balme. All rights reserved.

Enríquez, T. & Sabido, C. (2020). Finality, command and action [Finalidad, imperio y acción]. *Espíritu*, 69(160), 311-332. Article.

María Teresa Enríquez Gómez

Investigadora Asociada, Profesora investigadora

IMPERIUM AND CAUSALITY IN THOMAS AQUINAS

[IMPERIO Y CAUSALIDAD EN TOMÁS DE AQUINO]

ABSTRACT. Given certain free agent causal models inspired by Tomás de Aquino, it is interesting to look at the causal model presented by Aquinas himself, especially in a text from which the exposition of free action as the effect of the four Aris-

totelian causal senses. This is the question of the commanded acts (ST I-II, q. 17); in whose first four articles—and in its parallel texts—it determines that the will is an agent cause; practical reason, ordering cause; and the imperium of both (reason and will) is related to the ruling act as the formal with the material. © 2021 Nicolaus Copernicus University. All rights reserved.

Enríquez Gómez, M. T., & Montoya Camacho, J. M. (2021). Imperium and causality in Thomas Aquinas [Imperio y causalidad en Tomás de Aquino]. *Scientia et Fides*, 9(1), 329-355. doi: 10.12775/SETF.2021.013. Article.

María Teresa Enríquez Gómez

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INTERPERSONAL COMMANDS AND THE IMPERIUM-PRAECEPTUM DEBATE

ABSTRACT. He concept of "command" is central to the moral psychology of St. Thomas Aquinas. He has much to say, for instance, on the role of imperium (and related concepts, such as the actus imperatus) within his theory of human acts. He also describes prudence as consisting in part in an act that he calls the praeceptum. Yet St. Thomas never clarifies the relationship between these terms, both of which we could translate as "command." In the second half of the twentieth century, certain Thomists, such as Odon Lottin and René Gauthier, noted this problem and entered into a debate regarding the relationship (and possible equivalence) between these two Latin terms in the thought of St. Thomas. The discussion reached considerable proportions, to the point that more recently Michael Konrad referred to it as an "old cross of the Thomists." Scholars today still refer to the discussion, whether they consider it resolved or wish to further the [...].

Enríquez, T. & Carrasquillo, F. J. R. (2020). Interpersonal Commands and the Imperium-Praeceptum Debate. *Thomist*, 84(2), 207-231. doi: 10.1353/tho.2020.0010. Article.

Gustavo Adolfo Esparza Urzúa

SNI Nivel I

BODY AND SYMBOL IN ERNST CASSIRER: THE ORGANIC FUNCTION IN THE CONFORMATION OF CULTURAL WORLD. EDICIÓN ESPECIAL

[CUERPO Y SÍMBOLO EN ERNST CASSIRER: LA FUNCIÓN ORGÁNICA EN LA CONFORMACIÓN DEL MUNDO CULTURAL]

ABSTRACT. In this paper is studied the function of human body and its relation with the cul-

ture, in Ernst Cassirer's "Philosophy of Symbolic Forms". According to the neokantian, the relation soul-body conforms the basic relation to develop the Phenomenology of knowledge, nevertheless through the dialectic process is necessary to deny the material form to achieve the spiritual form of the culture, so the organic form, apparently, needs to be annulled in this dialectic progression. The aim is to analyze, and describe, how the form of the body appear in expressive mythical stage, but also in representative stage of language and significative stage of science, allowing the unity in the entire process of the construction of knowledge and the form of culture. © 2020, Universidade Estadual Paulista (UNESP). All rights reserved.

Esparza, G. (2020). Body and symbol in ernst cassirer: The organic function in the conformation of cultural world. edição especial. [Cuerpo y símbolo en ernst cassirer: La función orgánica en la conformación del mundo cultural]. *Trans/Form/Acao*, 43(S. I.), 205-230. doi: 10.1590/0101-3173.2020.V43ESP.16.P205. Article.

Ethel Beatriz Junco de Calabrese

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ALTERNATIVES FOR THE END OF THE WORLD: MYTH, TRAGIC DESTINY AND SCIENCE FICTION

[ALTERNATIVAS PARA EL FIN DEL MUNDO: MITO, DESTINO TRÁGICO Y CIENCIA FICCIÓN]

ABSTRACT. We propose a reading of Terminator: Dark Fate, the most recent installment of one of the most influential film sagas of contemporary science fiction, and we contrast it with the sense of the classic tragic destiny of The Trojans, by Euripides. From the configuration of the mytheme of the protective mother in the two protagonists (Hecuba / Sarah Connor), we stand out the mythemes that function as links between both of them. Respecting the properties of each genre, we observe that the woman-mother figure has an active position facing destiny with which she defines her heroic type and the fate of her community. We conclude stating that the mytheme's efficacy that sustains the filmic text it is based more on the mythical paradigm than on the scientific one. © 2020 Universidad Complutense de Madrid. All rights reserved.

Pérez-Amezcu, L. A. & Junco, E. (2020). Alternatives for the end of the world: Myth, tragic destiny and science fiction [Alternativas para el fin del mundo: Mito, destino trágico y ciencia ficción]. *Amaltea*, 12, 37-45. doi: 10.5209/AMAL.66691. Article.

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MYTH AND HISTORICAL MEMORY IN ELENA GARRO'S LOS RECUERDOS DEL PORVENIR

[MITO Y MEMORIA HISTÓRICA EN LOS RECUERDOS DEL PORVENIR DE ELENA GARRO]

ABSTRACT. *Los recuerdos del porvenir* remeda el período postrevolucionario mexicano desde un pueblo marginal y militarizado; la novela está articulada por mujeres de aspecto normal y de interioridad inescrutable. Garro expone su visión crítica de la historia a través de la radicalización de lo femenino mediante el personaje de Julia, construido sobre el modelo de Helena de Troya, como simbolización de la energía incontrolable de Afrodita. Una hermenéutica sustentada en paradigmas míticos apoya la lectura de los tópicos de la autora —género, poder político, discriminación, solidaridad— y amplía la difícil comprensión del fenómeno de base, brindando un acceso a la irracionalidad de los procesos históricos.

Junco, E. (2021). Mito y memoria histórica en Los recuerdos del porvenir de Elena Garro. *Iberoromania*, 2021(93), 19-35. doi: 10.1515/iber-2021-0003. Article.

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CAN ARISTOTLE'S LOGIC BE CONSIDERED A FORMAL LOGIC?

[¿SE PUEDE CONSIDERAR FORMAL LA LÓGICA DE ARISTÓTELES?]

ABSTRACT. In this paper I discuss the question of whether Aristotle's logic is a formal logic or not. I answer that, although the doctrines contained in the *Organon* inaugurate indeed formal logic, there are also good reasons to think that Aristotle did not believe that logic was a discipline that ought to prescind completely from content. © 2021 Universidad de Murcia Servicio de Publicaciones. All rights reserved.

Llovet Abascal, J. M. (2021). Can Aristotle's logic be considered a formal logic? [¿Se puede considerar formal la lógica de Aristóteles?]. *Daimon*, 82, 99-113. doi: 10.6018/DAIMON.344561. Article.

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WHY PLATO IS PRESENT FOR US?

[¿POR QUÉ ES ACTUAL PLATÓN QUOAD NOS?]

ABSTRACT. Plato is still current for several reasons. Some causes are internal, namely, the complete

transmission of the written legacy of the philosopher, a milestone in the history of ideas; the nine centuries of the Academy; and the intense political work undertaken by Plato and his disciples. Other causes are external, such as the reception of his doctrines in various moments of philosophy, in the face of the configuration of the Western mentality; and the dialogues with his interpreters and detractors. All of these are causes that allow us to approach the enormous political project of the Athenian philosopher that can only be separated from its binomial Plato-Platonism through analysis. This research highlights these causes both in the light of the main theses presented in the Dialogues, as well as their reception in the tradition, and their promotion in the light of Plato's political activity as we see in his Letters. © PENSAMIENTO.

Daza y García, R. R. (2021). Why Plato is present for us? [¿Por qué es actual Platón quoad nos?]. *Pensamiento*, 77(293), 195-209. doi: 10.14422/pen.v77.i293.y2021.011. Article.

José Alberto Ross Hernández

SNI Nivel II

ART AND NATURE IN PHYSICS II: USES AND SCOPE OF AN ANALOGY

[ARTE Y NATURALEZA EN FÍSICA II: USOS Y ALCANCES DE UNA ANALOGÍA]

ABSTRACT. The aim of this paper is to reconstruct the different uses of the analogy between *phúsis* and *téchne* that Aristotle introduces in Physics II. I will try to show that this comparison is referred to in order to exemplify a thesis, but also for arguing or defending a specific position, i.e. it can appear as a didactic resource, but also as a premise for an argument. This is a sign of a peculiar view about the structure of the reality. For ease of presentation, firstly, I will explain the use of the analogy between *phúsis* and *téchne* in the context of the definition about what is nature. Secondly, I will present the use of this comparison in the clarification of the two senses of *phúsis*. Finally, I will explore the apparition of these terms in the argumentation of Physics II 8. In these passages, Aristotle defends the presence of final causes in nature. © 2021 Claridades. All rights reserved.

Hernández, J. A. R. (2021). Art and nature in physics II: Uses and scope of an analogy [Arte y naturaleza en Física II: Usos y alcances de una analogía]. *Claridades*, 13(1), 51-65. doi: 10.24310/Claridadescrf.v13i1.10247. Article.

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