NOTICIAS DE INVESTIGACIÓN

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BOLETÍN BIMENSUAL DE INVESTIGACIÓN DE LA ETSIDI

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Este boletín informativo electrónico de periodicidad bimestral tiene como objetivo informar de las actividades de investigación desarrolladas en la ETS de Ingeniería y Diseño Industrial y recopilar los resúmenes de los artículos publicados en la Web of Science (WoS) de los que son autores o coautores investigadores de la Escuela.

PUBLICACIONES.

Thermo-chemical storage for renewable energies based on absorption: Getting a uniform injection into the grid.

Renewable energies, such as solar, wind or wave energies show intermittent production patterns that complicates their injection into an electrical grid. In order to overcome this inherent drawback, this paper proposes an innovative permanent storage system that uses both thermal and mass transfer internal processes based on absorption to store mechanical/electrical energy at large scales. This enables a manageable smoother power output to the grid, more suitable for trading. The system consists of two storage tanks for accumulating a liquid solution at two different pressures, connected with a compressor and an expander of the vapor absorbed/desorbed. An additional heat exchanger allows for recovering the absorption heat from the high-pressure tank seeking for storage efficiency. A detailed numerical simulation has been developed in order to predict the performance of the storage system under transient operating conditions and to determine the appropriate design parameters. The results show interesting and relevant conclusions about both the energy exploitation and the efficiency parameters of the energy storage system for reducing the intermittent electricity production.


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Efficiency vs Durability
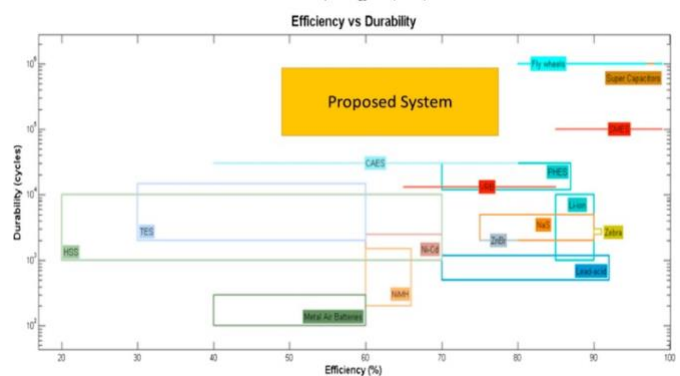
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Methodological proposal to classify and delineate natural protected areas. Study case: Region of Extremadura, Spain.

A significant change to Natural Protected Areas (NPAs) has been occurring worldwide. This change could cause concurrently potential damages related with NPA characteristics. Particularly, many regions of Spain face strong pressure due to their geographical, demographic and economic handicaps. This study presents a methodological proposal for properly classifying and delineating NPA, highlighted in a case region of Extremadura, being NATURA 2000 site of local heritage and one of less developed regions in European Union (EU). With Geographic Information System (GIS), the case region was firstly analyzed and then presented the real geo-socio-economic impact and environmental protection implementation, which urgently need to adopt a new methodological proposal with the complex and diverse legislations. Knowing the problems from the case region analyzed, the methodological proposal as the objective of this research describes how to define proper criteria, how to propose land use plan, and how to analyze socio-economic development with professional and public participation for NPA, and, therefore, to revitalize the problematic area. Thus, this methodological proposal as new valuable approach, which filling a niche of current outdated NPA, can be used and reapplied to other destinations with similar geographical characteristics for analyzing its current situations and predicting its future improvements.
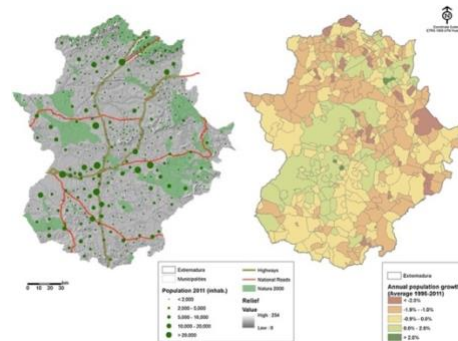
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Multidimensional membership functions in T-S fuzzy models for modelling and identification of nonlinear multivariable systems using genetic algorithms.

In this work, a new method for Takagi-Sugeno (T-S) fuzzy modelling based on multidimensional membership functions (MDMFs) is proposed. It is verified that the fuzzy inference method of one-dimensional membership functions (1DMFs) may place the fuzzy rules in inappropriate locations for modelling of nonlinear multivariable systems, while the application of MDMFs allows a better identification through a smaller number of fuzzy rules. The proposed method uses a genetic algorithm (GA) for the adjustment of the MDMFs and the T-S method for modelling and identification of the nonlinear system. As a validation example, a nonlinear multivariable system, a coupled tanks system, is chosen. The results show that the proposed method presents less identification error than the T-S method, with less number of fuzzy rules.
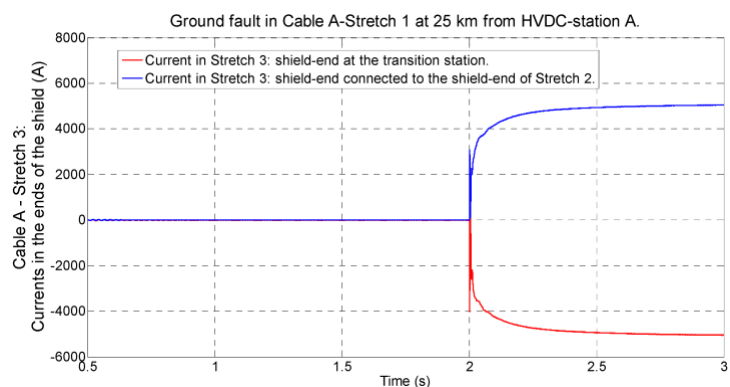
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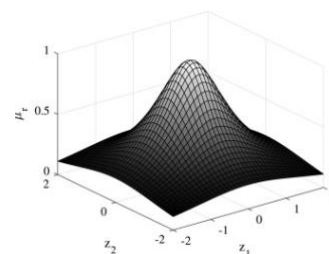
New Differential Protection Method for Multiterminal HVDC Cable Networks.

Ground faults in electrical power systems represent more than 90% of total faults. Their detection, location, and elimination are essential and must be carried out in a precise way to allow multiterminal high-voltage direct current (HVDC) cable networks to operate in stable conditions by removing only the faulty cable from service. This paper presents a new differential protection method based on the measurement of currents at both ends of the shields of power cables. This new method is cheaper and easier to set in operation compared to other protection methods that measure currents circulating in the active conductors. The values of such intensities and their polarities were evaluated to know which cable had a ground fault in a multiterminal HVDC cable network. The method was successfully validated by computer simulations, and experimental results were successfully obtained.

Ground fault in Cable A-Stretch 1 at 25 km from HVDC-station A.

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Does EU support contribute to economically successful Public-Private Partnerships (PPPs)? A panel data analysis of road PPP projects in Spain.

The EU infrastructure policy has relied on Public-Private Partnerships (PPPs) as a means to successfully deliver infrastructure of benefit for the EU. To reach its infrastructure policy objectives, the EU has implemented support mechanisms aimed at facilitating the delivery of PPPs. This article is aimed at evaluating to what extent these mechanisms have actually contributed to improving the economic performance of PPPs. To that end, we have selected the case of Spanish road PPPs for empirical analysis. The main result shows that EU support positively influences the economic performance of PPP projects. This is caused by the fact that the EU conditions its financial support on a project's meeting a set of requirements that help assure the success of the project. From this result, we obtain a set of conclusions that may be generalised to other cases, and provide a contribution to the body of knowledge on PPPs.
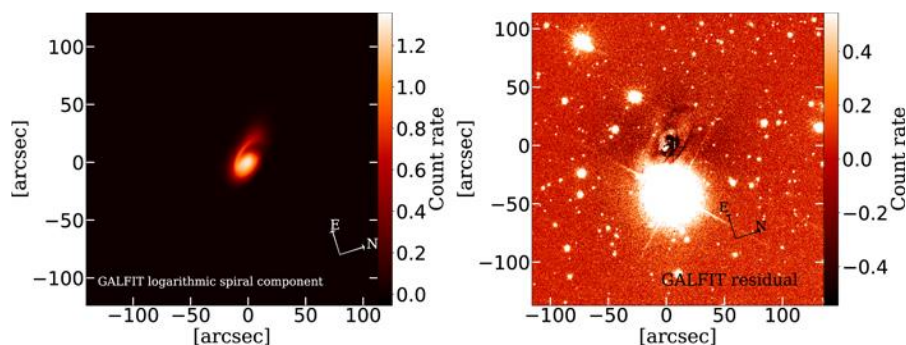
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High-resolution MEGARA Integral-field Unit Spectroscopy and Structural Analysis of a Fast-rotating, Disky Bulge in NGC 7025-Q1.

Disky bulges in spiral galaxies are commonly thought to form out of disk materials (mainly) via bar-driven secular processes. They are structurally and dynamically distinct from "classical bulges," which are built in violent merger events. We use high-resolution GTC/MEGARA integral-field unit spectroscopic observations of the Sa galaxy NGC 7025, obtained during the MEGARA commissioning run, together with detailed 1D and 2D decompositions of this galaxy's Sloan Digital Sky Survey i-band data to investigate the formation of its disky (bulge) component, which makes up similar to 30% of the total galaxy light. With a Sersic index n similar to 1.80 +/- 0.24, a half-light radius R-e similar to 1.70 +/- 0.43 kpc, and stellar mass M-* similar to (4.34 +/- 1.70) x 10(10) M-circle dot, this bulge dominates the galaxy light distribution in the inner R similar to 15 '' (similar to 4.7 kpc). Measuring the spins (lambda) and ellipticities (epsilon) enclosed within nine different circular apertures with radii R <= R-e, we show that the bulge, which exhibits a spin track of outwardly rising lambda and epsilon, is a fast rotator for all the apertures considered. Our findings suggest that this inner disky component is a pseudo-bulge, consistent with the stellar and dust spiral patterns seen in the galaxy down to the innermost regions but in contrast to the classical bulge interpretation favored in the past. We propose that a secular process involving the tightly wound stellar spiral arms of NGC 7025 may be driving gas and stars out of the disk into the inner regions of the galaxy, building up the massive pseudo-bulge.
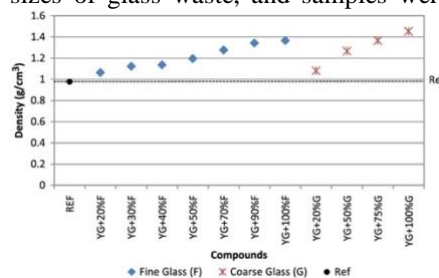
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Viability of Gypsum Composites with Addition of Glass Waste for Applications in Construction-Q2.

The design of greener materials is of great interest to develop eco-efficient construction systems, causing less environmental impact and following circular economy criteria. Accordingly, the current study aimed to analyze the viability to incorporate glass waste-from construction and demolition-in gypsum composites, promoting a circular economy in the building construction sector. Gypsum-based composites were formulated using different percentages and particle sizes of glass waste, and samples were prepared. These samples were tested in the laboratory, and the following characteristics were determined: dry density, surface hardness, mechanical strength, water absorption by capillarity, and thermal conductivity. Analysis comparing these composites to reference gypsum without additions showed that it is viable to prepare gypsum composites with the addition of glass waste to reduce water absorption by capillarity, improve mechanical strength, and increase surface hardness. All composites comply with the minimum requirements set by regulations. Therefore, these composites can be applied in the manufacturing of gypsum prefabricated elements or as interior coatings requiring special surface hardness, improved water behavior, and mechanical strength properties.

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ANALYSIS OF SURVIVAL TO THE DETECTION AND CORRECTION OF CONTAMINATION IN SERIES WITH VALUES BELOW THE DETECTION LIMIT.

Under article 17 of the Water Framework Directive the European Union was required to establish a framework to protect groundwater and set criteria for determining its chemical status and define environmental quality standards. Considering the specific characteristics of contaminants in groundwater, it is necessary to use adequate statistical tests. Annex IV of the Groundwater Directive establishes that all measurements below the limit of quantification (LOQ) must be replaced by half of the highest LOQ, with the exception of total pesticides. Although it is possible to estimate mean values in data censored with a single LOQ, its substitution distorts the confidence intervals used to verify tolerance with thresholds. The official monitoring networks lack series with values below the LOQ. In order to set up a methodological framework for its evaluation, nitrate concentration values have been taken in order to perform a subsequent artificial censorship. Two groundwater bodies with different monitoring characteristics and frequencies have been selected, Plana de Sagunto, in the eastern part of Spain, and a sector of the Central Valley (Chile), located around the systems of Tinguirica and Antivero rivers. Through the simulation of different percentages of censorship to data, several methods have been tested. Specific techniques for estimating censored values, such as Kaplan-Meier or robust regression have proven to be the most efficient to verify compliance with environmental standards.
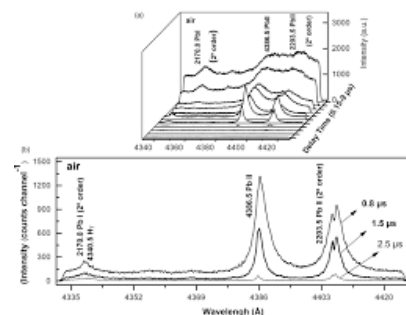
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Measurement of Laser-Induced Plasma: Stark Broadening Parameters of Pb(II) 2203.5 and 4386.5 angstrom Spectral Lines.

In this work, the Stark broadening parameters (widths and shifts) of the 2203.5 angstrom and 4386.5 angstrom Pb(II) spectral lines have been investigated and measured in laser-induced breakdown spectroscopy (LIBS), using a lead sample (99.999% purity). A Q-switched neodymium-doped yttrium aluminum garnet (Nd:YAG) laser operating at its fundamental wavelength (10 640 angstrom), generating pulses of 290 mJ, 7 ns of duration, and a repeat frequency of 20 Hz, has been used for the ablation of said lead sample in vacuum and in a controlled argon atmosphere. A study to understand the expansion dynamics of the lead produced plasma was performed. The spectra have been obtained and measured at different time delays of the plasma evolution in the range of 0.15-9 mu s, at which the temperature and electron number density are in the ranges of 28 200-8000 K and $1.3 \times 10(17)$ to $3 \times 10(15)$ cm(-3), respectively. A graphical representation of the evolution of temperature and electron number density versus 0.3 to 6.5 mu s delay from the laser pulse is presented. The important effect of the different environment where the plasma expands has been pointed out. Local thermodynamic equilibrium conditions have been checked. The obtained results of the Stark widths and shifts at the different temperatures and densities of electrons have been compared with the limited data available in the literature. This study aims to obtain more accurate values for these parameters and also to establish regularities and similarities for said parameters.

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