POLITÉCNICA

escuela técnica superior de ingeniería y diseño industrial

NOTICIAS DE INVESTIGACIÓN

ETS I+D+I

BOLETÍN BIMENSUAL DE INVESTIGACIÓN DE LA ETSIDI

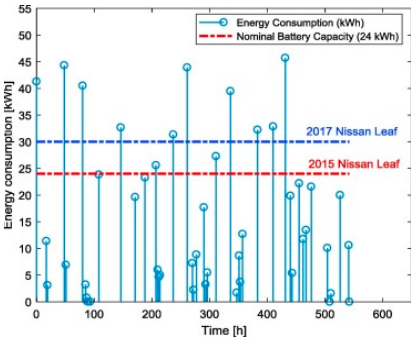
NÚMERO 2 MARZO – ABRIL DE 2018

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.

Using mobility information to perform a feasibility study and the evaluation of spatio-temporal energy demanded by an electric taxi fleet.

Half of the global population already lives in urban areas, facing to the problem of air pollution mainly caused by the transportation system. The recently worsening of urban air quality has a direct impact on the human health. Replacing today's internal combustion engine vehicles with electric ones in public fleets could provide a deep impact on the air quality in the cities. In this paper, real mobility information is used as decision support for the taxi fleet manager to promote the adoption of electric taxi cabs in the city of San Francisco, USA. Firstly, mobility characteristics and energy requirements of a single taxi are analyzed. Then, the results are generalized to all vehicles from the taxi fleet. An electrificability rate of the taxi fleet is generated, providing information about the number of current trips that could be performed by electric taxis without modifying the current driver mobility patterns. The analysis results reveal that 75.2% of the current taxis could be replaced by electric vehicles, considering a current standard battery capacity (24-30 kWh). This value can increase significantly (to 100%), taking into account the evolution of the price and capacity of the batteries installed in the last models of electric vehicles that are coming to the market. The economic analysis shows that the purchasing costs of an electric taxi are bigger than conventional one. However, fuel, maintenance and repair costs are much lower. Using the expected energy consumption information evaluated in this study, the total spatio-temporal demand of electric energy required to recharge the electric fleet is also calculated, allowing identifying optimal location of charging infrastructure based on realistic routing patterns.



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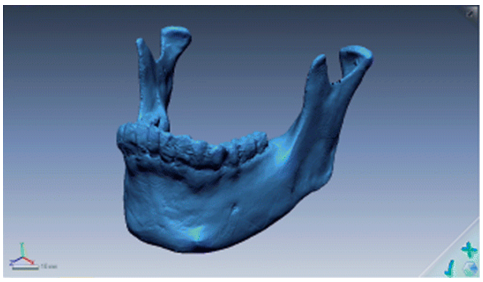
Different Digitalization Techniques for 3D Printing of Anatomical Pieces.



The use of different technological devices that allow the creation of three-dimensional models is in constant evolution, allowing a greater application of these technologies in different fields of health sciences and medical training. The equipment for digitalization is becoming increasingly sophisticated allowing obtaining three-dimensional which are more defined and similar to real image and original object. In this work, different modalities of designing 3D anatomical models of bone pieces are presented, for use by students of different disciplines in Health Sciences. To do this we digitalized bone pieces, with different models of scanners, producing images that can be transformed for 3D printing, with a Colido X 3045 printer by digital treatment with different software.

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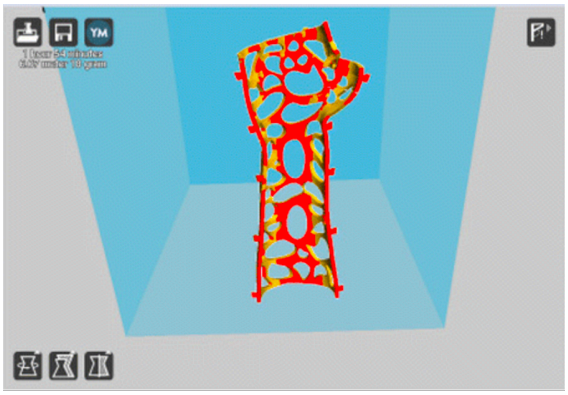
Design of an Orthopedic Product by Using Additive Manufacturing Technology: The Arm Splint.

The traditional fabrication process of custom-made splints has hardly undergone any progress since the beginning of its use at the end of the eighteenth century. New manufacturing techniques and the new materials can help to modernize this treatment method of fractures. The use of Additive Manufacturing has been proposed in recent years as an alternative process for the manufacture of splints and there has been an increase in public awareness and exploration. For this reason, in this study a splint model printed in 3D, that replaces the deficiencies of the cast maintaining its virtues, has been proposed. The proposed methodology is based on three-dimensional digitalization techniques and 3D modeling with reverse engineering software. The work integrates different scientific disciplines to achieve its main goal: to improve life quality of the patient. In addition, the splint has been designed based on the principles of sustainable development. The design of splint is made of Polycarbonate by technique of Additive Manufacturing with fused deposition manufacturing, and conceived with organic shapes, customizing openings and closing buttons with rubber. In this preliminary study the final result is a prototype of the 3D printed arm splint in a reduced scale by using PLA as material.



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Analysis and Fem Simulation Methodology of Dynamic Behavior of Human Rotator Cuff in Repetitive Routines: Musician Case Study.

The majority of musculoskeletal injuries located in the shoulder are often due to repetitive or sustained movements that occur in work routines in different areas. In the case of musicians, such as violinists, who have long and daily training routines, the repetitive movements they performare forced and sometimes the postures are not natural. Therefore, this article aims to study and simulate the dynamic behavior of the glenohumeral joint under repetitive conditions that represent the different postures assumed by a violinist during his daily training. For this purpose, the criteria provided by the RULA (rapid upper limb assessment) method have been used. Subsequently, by using as a reference geometry that of the articulation under study generated and modeled in CATIA (R) [VERSION 5R21], a FEM analysis has been proposed with the software ANSYS (R) [VERSION 17.1] simulating the short and cyclic movements of the Humerus of the violinists. With the analysis carried out, thanks to linear and isotropic approximations of the joint, it has been possible to know the approximate dynamic behavior of tissues, muscles and tendons, and the response of the joint in terms of fatigue.

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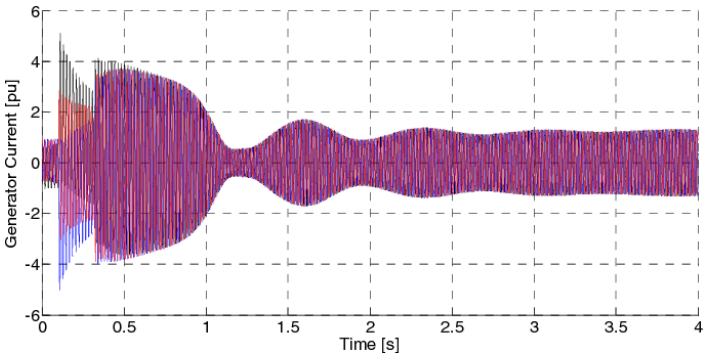
Review of Loss of Excitation Protection Setting and Coordination to the Generator Capacity Curve.

After the liberalization of electricity market the absorption of reactive power by some generator is subsidized in order to support the power system voltage regulation. The setting of the loss of excitation protection is essential to warranties the correct operation of the generator in the under-excited area. A conservative setting does not allow the maximum reactive power absorption. On the other hand a setting which allows the maximum reactive power absorption could be dangerous.

This paper presents a review of different settings recommendations for the loss of excitation protection and theirs coordination to the synchronous machine capacity curve. The settings have been validated through computer simulations.



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Novel Protection Method for Ground Faults Detection in Cables Used in Combined Overhead-Cable Lines in Power Systems.

This paper presents a new protection method for single phase ground faults detection in cables used in overhead cable lines in power transmission systems where the shields of the cables are connected according to the cross-bonding method The main contribution of this new protection method is that it can distinguish ground faults in the cable line side from ground faults at the overhead-line side. The new protection method is based on the measurements and analysis of the currents in the shields of the cable at the substation side, not at the cable end in the transition overhead-cable. The new method considers that the shields of the cables at the transition overhead-cable are not grounded sharing the same ground than the ending tower. Shields of the cables are connected according to the cross bonding method. This new protection method has been validated through computer simulations and experimental laboratory tests.

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Exoskeleton Robots for Rehabilitation: State of the Art and Future Trends.

In this paper a comprehensive review of exoskeletons for upper and lower limb rehabilitation is presented. Commercial robots with an emphasis on the pathologies they deal with are described and classified using the NASA Technology Readiness Level (TRL) metric. In addition, their movements and certifications are reviewed. Finally, future trends regarding the use of exoskeletons in the rehabilitation process are discussed.

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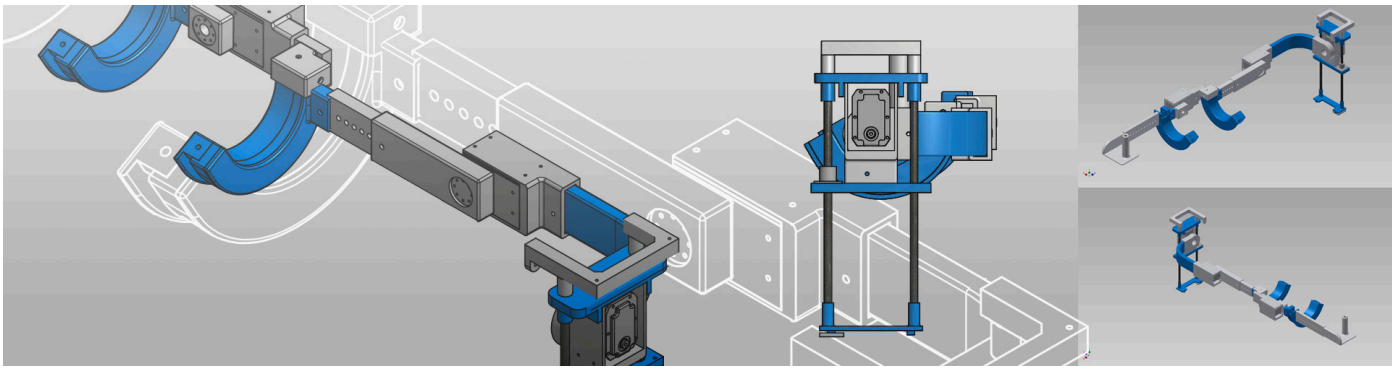
ORTE Exoskeleton: Actuation System Dimensioning and Selection

In this work is addressed the selection of the electric motors for an upper limb rehabilitation exoskeleton based on the evaluation of the resulting torques needed to perform a set of predefined trajectories considering three load scenarios. The trajectories considered correspond with pure joint movements and the daily living activity of eating. Furthermore, in order to provide smooth movements, it is implemented a sinusoidal-linear sinusoidal velocity profile. The torques profiles are obtained using the Simscape Multibody simulation environment. Considering the nominal and peaks velocity and resulting torques, it is proposed a set of electric motors commercially available from the manufacturer's catalogues.



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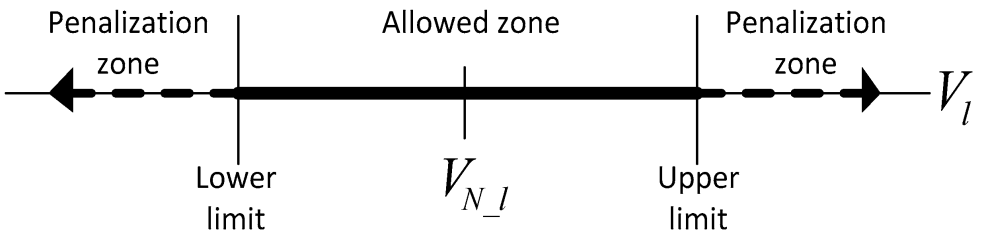
Power Loss Minimization for Transformers Connected in Parallel with Taps Based on Power Chargeability Balance.

In this paper, a model and solution approach for minimizing internal power losses in Transformers Connected in Parallel (TCP) with tap-changers is proposed. The model is based on power chargeability balance and seeks to keep the load voltage within an admissible range. For achieving this, tap positions are adjusted in such a way that all TCP are set in similar/same power chargeability. The main contribution of this paper is the inclusion of several construction features (rated voltage, rated power, voltage ratio, short-circuit impedance and tap steps) in the minimization of power losses in TCP that are not included in previous works. A Genetic Algorithm (GA) is used for solving the proposed model that is a system of nonlinear equations with discrete decision variables. The GA scans different sets for tap positions with the aim of balancing the power supplied by each transformer to the load. For this purpose, a fitness function is used for minimizing two conditions: The first condition consists on the mismatching between power chargeability for each transformer and a desired chargeability; and the second condition is the mismatching between the nominal load voltage and the load voltage obtained by changing the tap positions. The proposed method is generalized for any given number of TCP and was implemented for three TCP, demonstrating that the power losses are minimized and the load voltage remains within an admissible range.



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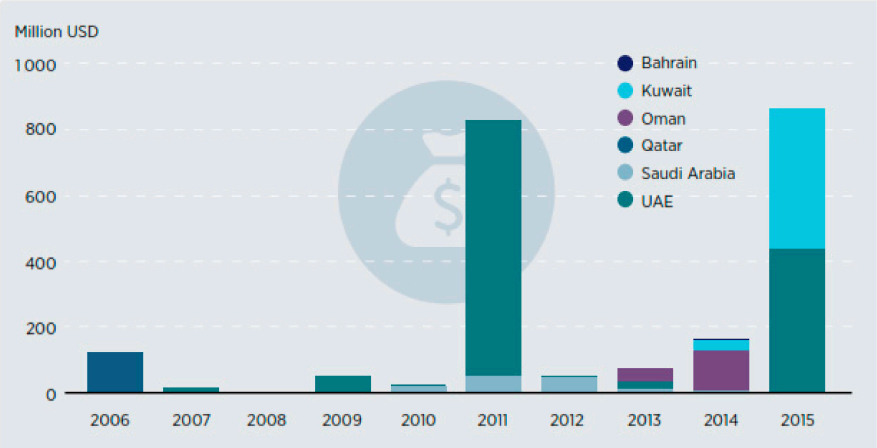
Solar Energy Potentials and Benefits in the Gulf Cooperation Council Countries: A Review of Substantial Issues.

It is a well-known fact that the fossil fuel industry has dominated the economy of the Gulf Cooperation Council (GCC) countries during the last few decades. However, recent developments show that most of the GCC countries plan to increase the share of renewable energy (RE) in their future electrical power production. To ensure realistic increase in the share of RE in the production of electricity in the future, firm policies must be laid down with the objective to promote and market the benefit of RE to their citizens. Due to the high-solar radiation in the GCC region, the focus is now on solar energy development. This paper presents an up-to-date review of the progress made on solar energy in the GCC together with the challenges and the way forward. Some of the challenges and barriers hindering the development of RE in the GCC are in the area of technological know-how, policy development, and insufficient application of RE technology integrated in the buildings among others. Areas of improvement include promoting research and development, public/private initiatives, legislation and regulatory framework, solutions to technical issues and exchange of knowledge, scientific advice, and last but not the least is the issue of building integration with RE.



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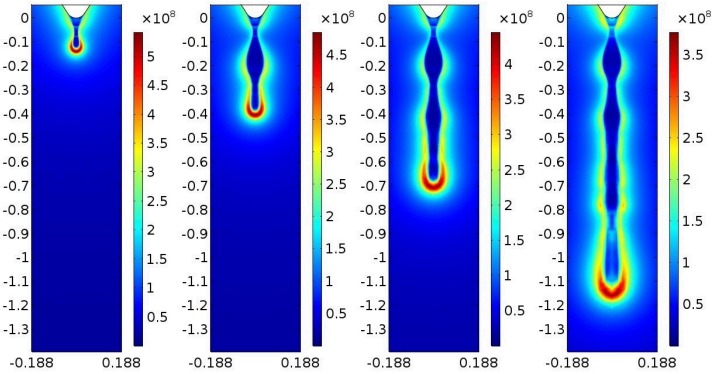
Comparison of Positive Streamers in Liquid Dielectrics with and without Nanoparticles Simulated with Finite-Element Software.

In this paper, a comparison of positive streamer diffusion propagation is carried out in three configurations of oil transformers: mineral transformer oil, mineral oil with solid dielectric barriers, and a nanofluid. The results have been solved using a finite-element method with a two-dimensional (2D) axi-symmetric space dimension selected. Additionally, previous results from other research has been reviewed to compare the results obtained. As expected, it is confirmed that the nanoparticles improve the dielectric properties of the mineral oil. In addition, it is observed that the dielectric solid blocks the propagation of the streamer when it is submerged with a horizontal orientation, thus perpendicular to the applied electric field. The computer used, with four cores (each 3.4 GHz) and 16 GB of RAM, was not sufficient for performing the simulations of the models with great precision. However, with these first models, the tendency of the dielectric behavior of the oil was obtained for the three cases in which the streamer was acting through the transformer oil. The simulation of these models, in the future, in a supercomputer with a high performance in terms of RAM memory may allow us to predict, as an example, the best concentration of nanoparticles to retard the streamer inception. Finally, other dielectric issues will be predicted using these models, such as to analyze the advantages and drawbacks of the presence of dielectrics inside the oil transformer.



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Influence of different boundary conditions of glass plates on human impact resistance.

Glass is commonly used in buildings, in most facades a security glazing has to be used according to safety standards. In Europe the standard EN 12600 establishes an impact test procedure for classification of glass from the point of view of the human security. However, this test does not replicate the actual dimensions and boundary conditions used in many building configurations and so the real stress distribution is not determined with this test.

In order to obtain a test facility for human impact against glass plates, the behaviour of a dummy plate made of aluminium has been studied with different boundary conditions using an aluminium plate frame and a support structure. A mixed approach is applied with modal test results and updated finite element models.

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Acceso WOS :000426851000027

Renewable energy management to identify suitable biomass facility location with GIS-based assessment for sustainable environment.

Identifying proper location of a biomass facility is a critical issue due to biomass materials characteristic geographically spread. This paper presents a GIS-MCDA approach with WLC and sensitivity analysis to optimize suitable areas of a biomass facility. The approach can be used to solve renewable energy planning problems in sustainable environment context. The results' analysis with 16 criteria concludes the most suitable locations close to agricultural and forestal areas, 8.64% of the Spanish case study region. Therefore, the results denote that the approach proposed could be used for decision-makings for renewable energy management policy in various governmental and industrial sectors. (C) 2017 The Authors. Published by Elsevier Ltd.

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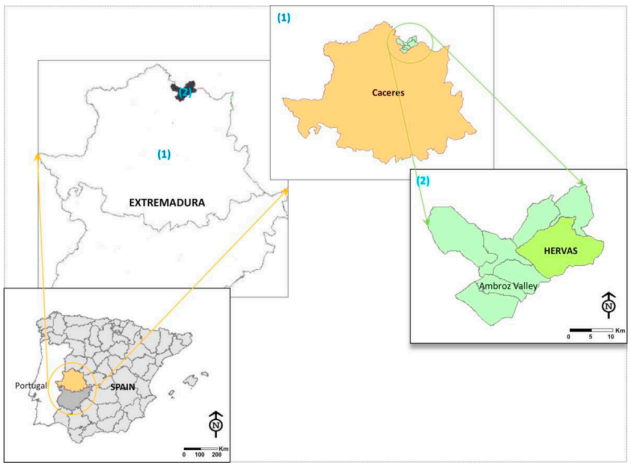

Examining desorptive capacity in supply chains: the role of organizational ambidexterity.

Purpose: The purpose of this paper is to explain how a buying organization's desorptive capacity relative to its supply network enhances the organization's supply chain competence. The research also analyzes the contingent role of the balanced and combined dimensions of ambidexterity in this relationship.

Design/methodology/approach: Empirical results are obtained through analysis of survey data from a sample of 270 European firms. Hierarchical regression analysis is used to test the hypotheses.

Findings: The results confirm, first, the positive and significant relationship between the buying organization's desorptive capacity and supply chain competence; and, second, the key moderating role of organizational ambidexterity, especially in its combined dimension, in this relationship.

Practical implications: The study suggests that desorptive capacity is key to the organization's contribution to supply chain competitiveness. The authors also provide practitioners with better understanding of the extent to which they should attempt to balance exploration and exploitation or/and to maximize both simultaneously when seeking greater benefit from desorptive capacity.

Originality/value: This study extends desorptive capacity research to supply chain management. It responds to calls in the desorptive capacity literature for deeper understanding of the benefits of desorptive capacity and of the role organizational ambidexterity plays in the success of desorptive capacity. By analyzing the independent effects of the combined and balanced dimensions of ambidexterity, the authors advance conceptual and operational understanding of the role of ambidexterity needed in the literature.

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Performing a new teaching trend based on “Learning by doing” by mixing different fields of knowledge as art and science.

European Higher Education Area (EHEA) has brought teaching methodologies developing a range of skills on the students to promote abilities they will need in the short term.

On the one hand, as a group of teachers coming from a degree in Fine Arts, but teaching in a scientific degree we have to face new challenges trying to introduce humanism aspects into the specific world of an engineer in industrial design. We want to develop fundamental aspects of art as the development of intellectual activities such as creating or interpreting, encouraging self-expression and perceptive student qualities.

If we consider that a product of engineering has to be built and enjoyed by human beings, this will require the work of a designer capable of infusing a differentiating touch to the technique, i. e. a human dimension. In this way we propose a methodology based on "learning by doing", making tangible products and bringing them into real world.

On the other hand we propose a collaborative and Problem-Based Learning challenge working together with engineers so as to deal with technical problems the students will have to face. It is a constant feed-back between students and teachers in an environment where all the proposals are heard.

Year after year we have been proposing as a final work in the subject of "Basic Design", the realisation of a sculpture, (generally dealing with nature in the way of obtaining curved shapes) made only with recycled cardboard triangles. They will learn how a combination of triangles can generate a well supported structure.

The greatest exponent of this proposal, among others, has been the realization of a tyrannosaurus rex made of cardboard, 13 meters long by 7 meters high, which also served as the stage for a fashion show. Drawing the whole process and the final object are a way of thinking and solving in a different way an engineering problem. All the students working together with other teachers not related to the subject they were attending, and with university maintenance staff is the best expression of a collaborative work.

As was lapsing the course students were motivating increasingly looking how their work was exposed to all the academic community and to all the persons from the neighbourhood who wanted to gaze at it. The result of assessment working with this methodology improved highly, rising their enthusiasm, their commitment in order to obtain better results and recognition of a good job.

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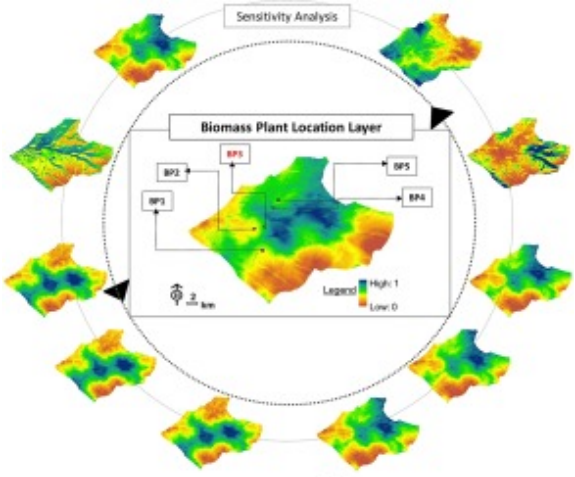
Optimizing the location of a biomass plant with a fuzzy-DEcision-MAking Trial and Evaluation Laboratory (F-DEMATEL) and multi-criteria spatial decision assessment for renewable energy management and long-term sustainability.

The selection of the location of a biomass plant is a critical concern because biomass feedstocks are geographically and spatially dispersed. Geographic Information System-Multi-Criteria Decision Analysis (GIS-MCDA) techniques are powerful methods that have been applied to various disciplines using suitable criteria. These methods can be used to solve power planning problems, such as determining the optimal locations of biomass plants in the context of renewable energy. In response to the promotion of renewable energy in European strategy, Extremadura (Spain) is boosting energy generation from biomass as an alternative to traditional generation to protect the environment. This study presents a combined application of GIS-MCDA and the Fuzzy-DEcision-MAking Trial and Evaluation Laboratory (F-DEMATEL) technique to identify suitable and favorable sites for biomass facilities in terms of long-term sustainability. The main criteria established in this approach are outlined, evaluated, weighted and allocated to three criteria groups: environmental, geophysical and socio-economic groups. In the F-DEMATEL participatory method, constraints and their weight coefficients, with regard to their influence, are calculated. The most suitable locations are obtained after applying the Weighted Linear Combination (WLC) method. In the final stage of the decision-making problem, a sensitivity analysis of the criteria set is conducted, and the weights are determined for four implementation strategies. The model is applied in a case study of Extremadura where forest and agriculture are the typical land uses. The results of the F-DEMATEL/GIS-MCDA analysis suggest that the optimal sites for the locations of biomass plants are situated near forests and in zones with low transport costs, which comprise only 9.247% (Sh) of the total study area. Currently, five plants are installed in this area; however, they are not located in the most suitable areas (Sh). The most influential criteria of the model are the vegetation cover, agricultural area, transport cost and potential demand criteria. This methodology can be used in other studies to verify suitable locations for biomass plants in areas with similar geographical and spatial characteristics and available spatial data. Additionally, the proposed method of renewable energy policy planning can be applied to decision-making problems in the private sector and at various government levels.



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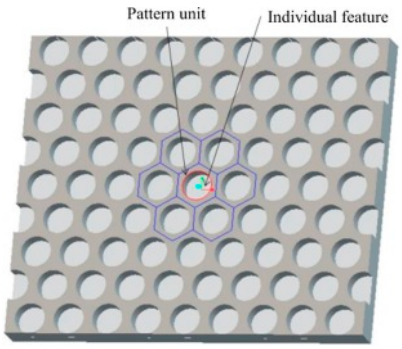
Comparison of methods for outlier identification in surface characterization.

Raw data provided by measurement instruments like confocal microscopy often contains non-measured points and outliers. Ten statistical methods for outlier identification which can be implemented in the area of surface metrology are analysed and compared. These methods for outlier identification are introduced and their corresponding algorithms for data pre-processing before surface characterization are developed. Twenty-four Mat files were created based on two standard data sets provided by the National Institute of Standards and Technology. These files were assigned by four factors with two to three levels to represent all possible surface types. Based on processing the same series of contaminated data sets, the number of missed outliers, the difference of the height parameters, and the elapsed time by each method are compared. Algorithm efficiency, robustness, breakdown point, limitations, advantages, etc. are compared and analysed. Two of those ten methods were combined to know their potential. A type C1 spacing standard artefact was measured by 3D image confocal microscopy, and the data was processed by those algorithms. The difference of Sa and that of elapsed time are compared.



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Stark broadening parameters and transition probabilities of persistent lines of Tl II.

The presence of singly ionized thallium in the stellar atmosphere of the chemically peculiar star chi Lupi was reported by Leckrone et al. in 1999 by analysis of its stellar spectrum obtained with the Goddard High Resolution Spectrograph (GHRS) on board the Hubble Space Telescope. Atomic data about the spectral line of 1307.50 angstrom and about the hyperfine components of the spectral lines of 1321.71 angstrom and 1908.64 angstrom were taken from different sources and used to analyse the isotopic abundance of thallium II in the star chi Lupi. From their results the authors concluded that the photosphere of the star presents an anomalous isotopic composition of Tl II. A study of the atomic parameters of Tl II and of the broadening by the Stark effect of its spectral lines (and therefore of the possible overlaps of these lines) can help to clarify the conclusions about the spectral abundance of Tl II in different stars. In this paper we present calculated values of the atomic transition probabilities and Stark broadening parameters for 49 spectral lines of Tl II obtained by using the Cowan code including core polarization effects and the Griem semiempirical approach. Theoretical values of radiative lifetimes for 11 levels (eight with experimental values in the bibliography) are calculated and compared with the experimental values in order to test the quality of our results. Theoretical trends of the Stark width and shift parameters versus the temperature for spectral lines of astrophysical interest are displayed. Trends of our calculated Stark width for the isoelectronic sequence Tl II-Pb III-Bi IV are also displayed.

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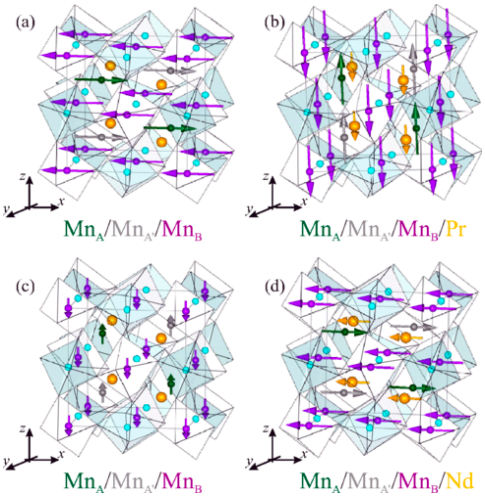
Anisotropic magnetic structures of the MnRMnSbO6 high-pressure doubly ordered perovskites (R = La, Pr, and Nd).



A new type of doubly ordered perovskite (also reported as double double perovskite, DDPv) structure combining columnar and rock-salt orders of the cations at the A and B sites, respectively, was recently found at high pressure for MnRMnSbO6 (R = La-Sm). Here we report further magnetic structures of these compounds. Mn2+ spins align into antiparallel ferromagnetic sublattices along the x axis for MnLaMnSbO6, while the magnetic anisotropy of Pr3+ magnetic moments induces their preferential order along the z direction for MnPrMnSbO6. The magnetic structure of MnNdMnSbO6 was reported to show a spin-reorientation transition of Mn2+ spins from the z axis towards the x axis driven by the ordering of Nd3+ magnetic moments. The crystal-field parameters for Pr3+ and Nd3+ at the 4eC(2) site of their DDPv structure have been semiempirically estimated and used to derive their energy levels and associated wave functions. The results demonstrate that the spin-reorientation transition in MnNdMnSbO6 arises as a consequence of the crystal-field-induced magnetic anisotropy of Nd3+.

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Left-symmetric algebras and homogeneous improper affine spheres.

The nonzero level sets in n-dimensional flat affine space of a translationally homogeneous function are improper affine spheres if and only if the Hessian determinant of the function is equal to a nonzero constant multiple of the nth power of the function. The exponentials of the characteristic polynomials of certain left-symmetric algebras yield examples of such functions whose level sets are analogues of the generalized Cayley hypersurface of Eastwood-Ezhov. There are found purely algebraic conditions sufficient for the characteristic polynomial of the left-symmetric algebra to have the desired properties. Precisely, it suffices that the algebra has triangularizable left multiplication operators and the trace of the right multiplication is a Koszul form for which right multiplication by the dual idempotent is projection along its kernel, which equals the derived Lie subalgebra of the left-symmetric algebra.

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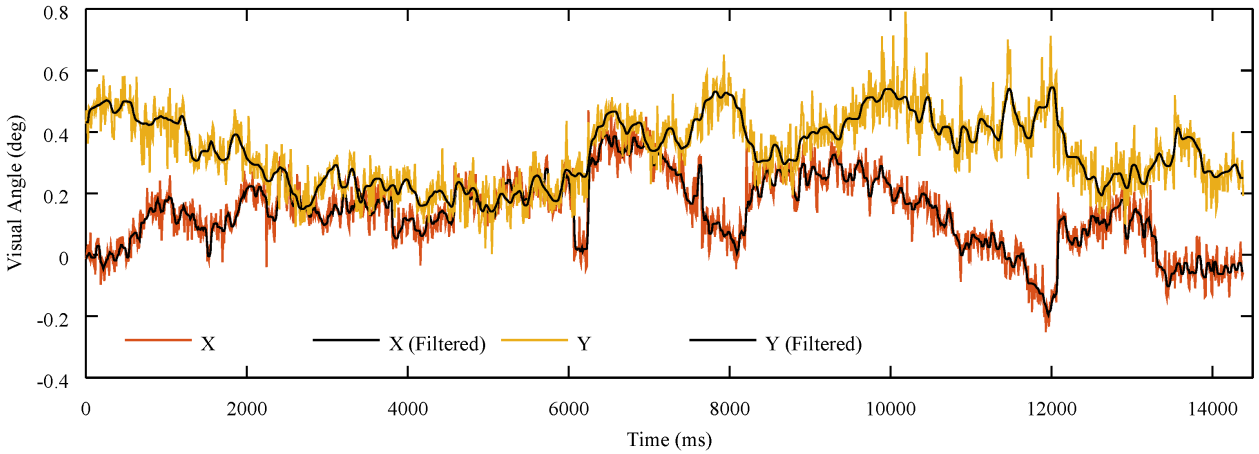
OSCANN: Technical Characterization of a Novel Gaze Tracking Analyzer.

Eye-movement analysis has grown exponentially in recent decades. The reason is that abnormalities in oculomotor movements are usually symptoms of injuries in the nervous system. This paper presents a novel regulated solution named OSCANN. OSCANN aims at providing an innovative tool for the control, management and visualization of oculomotor neurological examinations. This solution utilizes an eye-tracker sensor based on video electro-oculography (VOG) technology to capture eye movements and store them in video files. Such a sensor can store images at a rate of 100 frames per second. A characterization study was performed using twenty-two volunteers (13 male, 9 female, ages 22-45 years, mean 29.3 years, SD = 6.7) to assess the accuracy and precision specifications of OSCANN during oculomotor movement analysis. The accuracy was evaluated based on the offset, whereas precision was estimated with Root Means Square (RMS). Such a study reported values lower than 0.4 degrees and 0.03 degrees of accuracy and precision, respectively. These results suggest that OSCANN can be considered as a powerful tool to measure oculomotor movement alterations involved in some neurological disease progression.



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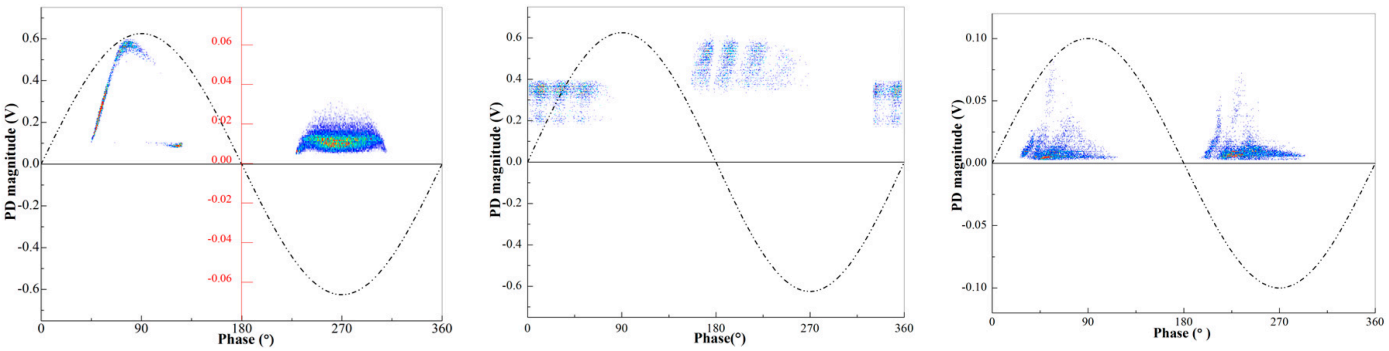
Partial Discharge Monitoring on Metal-Enclosed Switchgear with Distributed Non-Contact Sensors.

Metal-enclosed switchgear, which are widely used in the distribution of electrical energy, play an important role in power distribution networks. Their safe operation is directly related to the reliability of power system as well as the power quality on the consumer side. Partial discharge detection is an effective way to identify potential faults and can be utilized for insulation diagnosis of metal-enclosed switchgear. The transient earth voltage method, an effective non-intrusive method, has substantial engineering application value for estimating the insulation condition of switchgear. However, the practical application effectiveness of TEV detection is not satisfactory because of the lack of a TEV detection application method, i.e., a method with sufficient technical cognition and analysis. This paper proposes an innovative online PD detection system and a corresponding application strategy based on an intelligent feedback distributed TEV wireless sensor network, consisting of sensing, communication, and diagnosis layers. In the proposed system, the TEV signal or status data are wirelessly transmitted to the terminal following low-energy signal preprocessing and acquisition by TEV sensors. Then, a central server analyzes the correlation of the uploaded data and gives a fault warning level according to the quantity, trend, parallel analysis, and phase resolved partial discharge pattern recognition. In this way, a TEV detection system and strategy with distributed acquisition, unitized fault warning, and centralized diagnosis is realized. The proposed system has positive significance for reducing the fault rate of medium voltage switchgear and improving its operation and maintenance level.



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