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Anuario de Investigación, Innovación y Emprendimiento



2018

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Presentación

Con el pasar de los años la investigación científica se ha vuelto un pilar fundamental que ha subsanado los retos que la globalización continúa imponiendo en el mundo. Sin embargo, para nadie es un secreto que las realidades de cada comunidad son diferentes y por ende los retos que presentan cada una, se desarrollan de manera distinta. Es ahí donde la investigación científica entra a generar nuevos conocimientos que impactan en el desarrollo de las sociedades.

La edición del Anuario de Investigaciones 2018, de la Universidad Tecnológica de Bolívar, es una compilación de Artículos y Conference Papers, que representan la apuesta de la Universidad por la generación de nuevo conocimiento a través de su comunidad académica.

La Universidad, continúa sus esfuerzos por fortalecer la investigación, brindando a su cuerpo de investigadores las herramientas necesarias que les permitan generar un ecosistema de trabajo productivo en el campo de la investigación, para esto se viene invirtiendo en infraestructura y relacionamiento a nivel local, regional e internacional, buscando siempre la generación de nuevo conocimiento que le permita a la Universidad Tecnológica de Bolívar ser una institución reconocida por la comunidad científica en general y teniendo siempre como prioridad la transformación y mejoramiento de la Región Caribe.

Jairo F. Useche Vivero Director Investigación, Innovación y Emprendimiento

Anuario de Investigaciones 2017

FACULTAD DE INGENIERÍA

Control of a SMES for mitigating subsynchronous oscillations in power systems: A PBC-PI approach

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Abstract

This paper proposes a methodology to control the active and reactive power of a superconducting magnetic energy storage (SMES) system to alleviate subsynchronous oscillations (SSO) in power systems with series compensated transmission lines. Primary frequency and voltage control are employed to calculate the active and reactive power reference values for the SMES system, and these gains are calculated with a particle swarm optimization (PSO) algorithm. The proposed methodology is assessed with a classical PI controller, feedback linearization (FL) controller and a passivity-based PI control (PI-PBC). Operating limits for VSC are also considered, which gives priority to active power over reactive power. The IEEE Second Benchmark model is employed to demonstrate the assessment of the proposed methodology where PI-PBC presents better performance than the classical PI and FL controllers in all the operating conditions considered.

Publiched: Journal of Energy Storage, Vol. 20, 2018, pp. 163-172

Linear power flow formulation for low-voltage DC power grids

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Abstract

This paper presents a reformulation of the power flow problem in low-voltage dc (LVDC) power grids via Taylor's series expansion. The solution of the original nonlinear quadratic model is achieved with this proposed formulation with minimal error when the dc network has a well defined operative conditions. The proposed approach provides an explicit solution of the power flow equations system, which avoids the use of iterative methods. Such a characteristic enables to provide accurate results with very short processing times when real operating scenarios of dc power grids are analyzed. Simulation results verify the precision and speed of the proposed method in comparison to classical numerical methods for both radial and mesh configurations. Those simulations were performed using C++ and MATLAB, which are programming environments commonly adopted to solve power flows.

Publiched: Electric Power Systems Research, Vol. 163, 2018, pp. 375-381

Boundary element analysis of laminated composite shear deformable shallow shells

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Abstract

In this work, a Boundary Element Method formulation for stress analysis of symmetrically laminated composite thick shallow shells is presented. The proposed formulation was obtained by coupling the boundary element formulation of shear deformable symmetrically laminated composite plates and the boundary element formulation for two-dimensional anisotropic plane stress analysis. Formulation uses the elastostatic anisotropic fundamental solutions proposed for these formulations. Domain integrals are transformed to the boundary by using the Radial Integration Method. Numerical examples are presented to demonstrate the efficiency and accuracy of the formulation. Obtained results concur with results available in the literature as well as with finite element results.

Publiched: Composite Structures, Vol. 199, 2018, pp. 24-37

Passivity-based PI control of a SMES system to support power in electrical grids: A bilinear approach

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Abstract

A bilinear proportional-integral (PI) controller based on passivity-based formulations for integrating superconducting magnetic energy storage (SMES) devices to power ac microgrids is proposed in this paper. A cascade connection between a dc–dc chopper and a voltage source converter is made to integrate the SMES system. The proposed controller guarantees asymptotically stability in the Lyapunov's sense under closed-loop operation. This controller exploits the well-known advantages of the proportional-integral (PI) actions via passivation theory. Active and reactive power compensation in the ac system through the SMES integration is proposed as the control objective. To achieve this goal, a radial ac distribution feeder with high penetration of distributed energy resources and time-varying loads is employed. The effectiveness and the robustness of the proposed bilinear PI controller verified by comparing its dynamical performance to conventional approaches such as conventional PI and feedback controllers. All simulation results are conducted via MATLAB/SIMULINK software by using SimPowerSystem library.

Publiched: Journal of Energy Storage, Vol. 18, 2018, pp. 459-466

Optimal selection of conductors in distribution systems using tabu search algorithm

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Abstract

An efficient methodology for the optimal selection of conductor in distribution systems through the implementation of the metaheuristic optimization technique called Tabu Search is presented in this paper. To represent the problem a mono-objective mathematical model of nonlinear mixed integer type is used. The minimization of investment costs of conductors and operating costs (power losses) for a study period of one year is considered as objective function. A single-phase equivalent system is used for the evaluation. The set of constraints relates to technical and operational characteristics of the system, which are assessed through a backward/forward sweep load flow. Initial configuration to tabu search algorithm is created by using a constructive heuristic that ensures feasibility of the initial solution; to generate the neighborhood strategies of tree searching and graph theory are used. In order to verify its applicability and efficiency, two test feeders of specialized literature are employed, obtaining better quality results than those reported in the literature.

Publiched: Ingeniare, vol.26, N°2, 2018, pp.283-295

Application of data mining for the classification of university programs of industrial engineering accredited in high quality in Colombia

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Abstract

The present research article proposes a method to classify University engineering programs, placing special attention to relations between the subjects of the curriculum and the 12 areas of knowledge established in the body of competencies published by the Institute of industrial and System Engineers (IIES). Techniques of unsupervised data analysis such as Principal Components Analysis (PCA) and cluster analysis were used for the proposed classification. Twenty-one programs, accredited by high quality in Industrial Engineering in Colombia, are used as units of study. The results show that factors such as international accreditation, size of the faculties of engineering and University profile, influence the grouping of the programs of study. The research allowed to classify three large main components and profiles of accredited programs.

Publiched: Información Tecnológica, Vol. 29, N°.3, 2018, pp. 89-96

Indirect IDA-PBC for active and reactive power support in distribution networks using SMES systems with PWM-CSC

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Abstract

In this paper an indirect interconnection and damping assignment passivity-based control (IDA-PBC) applied to the three-phase superconducting magnetic energy storage systems (SMES) is proposed to support active and reactive power in distribution systems. The SMES is connected to the distribution network using a pulse-width-modulated current source converter (PWM-CSC), due to its intrinsic current features that are more natural for controlling the current of a superconducting coil. A Hamiltonian function is selected as an hyperboloid representation taking into account the open loop dynamics of the system. The indirect control strategy is used to decouple the dynamical behavior between ac and dc side of the converter is employed as a supervisor controller for active power interchange. Simulation results demonstrate the efficiency and robustness of the proposed control methodology applied on a low-voltage distribution network under different operative conditions where the tracking errors were less than 6.2%.

Publiched: Journal of Energy Storage, Vol. 17, 2018, pp. 261-271

Accounting for attitudes on parking choice: An integrated choice and latent variable approach

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Abstract

The well-differentiated impact that parking supply options produce on congestion, pollution and land consumption arouses the interest of policy makers for a better understanding of car user's behavior when choosing a parking option. Despite the evidence on the advantages of hybrid discrete choice models, most literature on parking choice only involves observable factors while leaving aside issues related to the latent variables. The behavioral hypothesis is that parking choice process depends not only on a set of observable factors but also has to do with individual-specific latent attributes. A hybrid discrete choice model with interactions among attitudes and observable factors, as well as among socioeconomic characteristics and observable factors, was estimated in order to consider individual heterogeneity. The results showed that, in addition to parking fee, search time and access time, a Risk-averse attitude and a Positive car care (maintenance) attitude are determinants for parking choice. The

inclusion of these latent attributes and their interactions also resulted in a large improvement in the goodness-of-fit of the model and affected the time valuations.

Publiched: Transportation Research Part A: Policy and Practice, Vol. 111, 2018, pp. 65-77

Subatmospheric pressure in a water draining pipeline with an air pocket

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Abstract

An air pocket's behaviour inside of a pipeline during transient conditions is of great importance due to its effect on the safety of the hydraulic system and the complexity of modeling its behaviour. The emptying process from water pipelines needs more assessment because the generation of troughs of subatmospheric pressure may lead to serious damage. This research studies the air pocket parameters during an emptying process from a water pipeline. A well-equipped experimental facility was used to measure the pressure and the velocity change throughout the water emptying for different air pocket sizes and valve opening times. The phenomenon was simulated using a one-dimensional (1D) developed model based on the rigid formulation with a non-variable friction factor and a constant pipe diameter. The mathematical model shows good ability in predicting the trough of subatmospheric pressure value as the most important parameter which can affect the safety of hydraulic systems.

Publiched: Urban Water Journal, Vol. 15, N°. 4, 2018, pp. 346-352

Rigid water column model for simulating the emptying process in a pipeline using pressurized air

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Abstract

This paper presents a mathematical model for analyzing the emptying process in a pipeline using pressurized air. The rigid water column model (RWCM) is used to analyze the transient phenomena that occur during the emptying of the pipeline. The air-water interface is also computed in the proposed model. The proposed model is applied along a 271.6-m-long PVC-steel pipeline with a 232-mm internal

diameter. The boundary conditions are given by a high-pressure air tank at the upstream end and a manual butterfly valve at the downstream end. The solution was carried out in a computer modeling program. The results show that comparisons between both the computed and measured water flow oscillations and gauge pressures are very similar; hence, the model can effectively simulate the transient flow in this system. In addition, the results indicate that the proposed model can predict both the water flow and gauge pressure better than previous models.

Publiched: Journal of Hydraulic Engineering, Vol. 144, N°. 4, 2018, Article Number 06018004

DERs integration in microgrids using VSCs via proportional feedback linearization control: Supercapacitors and distributed generators

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Abstract

This paper presents an exact feedback linearization control strategy for voltage source converters (VSCs) applied to the integration of distributed energy resources (DERs) in smart distribution systems and microgrids. System dynamics is represented by an average nonlinear model which is transformed algebraically into an equivalent linear model by simple substitutions, avoiding to use Taylor's series or another equivalent linearization technique. The equivalent linear model preserves all characteristics of the nonlinear model, which implies that the control laws obtained are completely applicable on its nonlinear representation. Stability analysis is made using the passivity-based technique. The exact feedback linearization control in combination with passivity-based control (PBC) theory guarantees to obtain a global asymptotically stable controller in the sense of Lyapunov for its closed-loop representation. The effectiveness and robustness of the proposed methodology is tested in a low-voltage microgrid with a photovoltaic system, a supercapacitor energy storage (SCES) device and unbalance loads. All simulation scenarios are conducted in MATLAB/SIMULINK environment via SimPowerSystem library.

Publiched: Journal of Energy Storage, Vol. 16, 2018, pp. 250-258

A generalized passivity-based control approach for power compensation in distribution systems using electrical energy storage systems

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Abstract

This paper presents a generalized interconnection and damping assignment passivity-based control (IDA-PBC) for electric energy storage systems (EESS) such as: superconducting magnetic energy storage (SMES) and supercapacitor energy storage (SCES). A general framework is proposed to represent the dynamical behavior of EESS interconnected to the electrical distribution system through forced commutated power electronic converters. A voltage source converter (VSC) and a pulse-width modulated current source converter (PWM-CSC) are used to integrate SCES and SMES systems to the electrical power systems respectively. The proposed control strategy allows active and reactive power interchange between the EESS and electric distribution grids independently, guaranteeing globally asymptotically convergence in the sense of Lyapunov via Hamiltonian formulation. Simulation results show the effectiveness and robustness of the generalized IDA-PBC to operate EESS as active and reactive power compensator in order to improve operative conditions in power distribution grids under balanced and unbalanced conditions.

Publiched: Journal of Energy Storage, Vol. 16, 2018, pp. 259-268

Optimization of convective drying assisted by ultrasound for Mango Tommy (Mangifera indica L.)

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Abstract

Convective drying is a conventional method to prolong the shelf-life of foods that could negatively affect the product quality due to the long exposure time to high temperature. Ultrasound (US) has been used for reducing the drying time while maintaining the product quality. In this study a Box-Behnken design of Response Surface Methodology (RSM) was used to evaluate the effects of US time-frequency (t), US power level (Pot), and hot air temperature (T) on the drying process time (DPT), apparent density (AD), and color difference (ΔE) of the dried mango slices (10.0 ± 1.0% wet basis). Fisher's statistical testing was performed for the analysis of variance (ANOVA) for quadratic regression equations. The optimization goals were to minimize the responses. Modeled optimized conditions were 52–55°C, 45–60 W, and 3 min/30 min for T, Pot, and t, respectively. Energy consumption and carbon footprint were also estimated during the validation of the optimal drying conditions.

Publiched: Journal of Food Process Engineering, Vol. 41, N° 1, 2018, pp. p.1 - 9

Features of Dengue and Chikungunya Infections of Colombian Children under 24 Months of Age Admitted to the Emergency Department

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Abstract

We aimed to assess clinical and laboratory differences between dengue and chikungunya in children <24 months of age in a comparative study. We collected retrospective clinical and laboratory data confirmed by NS1/IgM for dengue for 19 months (1 January 2013 to 17 August 2014). Prospective data for chikungunya confirmed by real-time polymerase chain reaction were collected for 4 months (22 September 2014-14 December 2014). Sensitivity and specificity [with 95% confidence interval (CI)] were reported for each disease diagnosis. A platelet count <150000 cells/ml at emergency admission best characterized dengue, with a sensitivity of 67% (95% CI, 53-79) and specificity of 95% (95% CI, 82-99). The algorithm developed with classification and regression tree analysis showed a sensitivity of 93% (95% CI, 68-100) and specificity of 38% (95% CI, 9-76) to diagnose dengue. Our study provides potential differential characteristics between chikungunya and dengue in young children, especially low platelet counts.

Publiched: Journal of Tropical Pediatrics, Vol. 64, N° 1, pp. 31-37

Emptying Operation of Water Supply Networks

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Abstract

Recently, emptying processes have been studied in experimental facilities in pipelines, but there is a lack regarding applications in actual pipelines, which permits establishing the risk of collapse because of subatmospheric pressure occurrence. This research presents a mathematical model to simulate the emptying process of water supply networks, and the application to a water emptying pipeline with nominal diameter of 1000 mm and 578 m long which is located on the southern of Cartagena, Bolívar Department, Colombia. In the application, both pipes and the air valve data manufacturer were considered. The behavior of all hydraulic and thermodynamic variables is considered. Results show that is crucial to know sub-atmospheric pressure values to prevent the collapse of the pipeline. The application of the mathematical model confirms that the hydraulic system is well designed depending on air valve sizes and maneuvering of drain valve.

Publiched: *Water*, Vol. 10, N° 1, 2018, Article Number 22.

Effect of the Non-Stationarity of Rainfall Events on the Design of Hydraulic Structures for Runoff Management and Its Applications to a Case Study at Gordo Creek Watershed in Cartagena de Indias, Colombia

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Abstract

The 24-h maximum rainfall (P24h-max) observations recorded at the synoptic weather station of Rafael Núñez airport (Cartagena de Indias, Colombia) were analyzed, and a linear increasing trend over time was identified. It was also noticed that the occurrence of the rainfall value (over the years of record) for a return period of 10 years under stationary conditions (148.1 mm) increased, which evidences a change in rainfall patterns. In these cases, the typical stationary frequency analysis is unable to capture such a change. So, in order to further evaluate rainfall observations, frequency analyses of P24h-max for stationary and non-stationary conditions were carried out (by using the generalized extreme value distribution). The goodness-of-fit test of Akaike Information Criterion (AIC), with values of 753.3721 and 747.5103 for stationary and non-stationary conditions respectively, showed that the latter best depicts the increasing rainfall pattern. Values of rainfall were later estimated for different return periods (2, 5, 10, 25, 50, and 100 years) to quantify the increase (non-stationary versus stationary condition), which ranged 6% to 12% for return periods from 5 years to 100 years, and 44% for a 2-year return period. The effect of these findings were tested in the Gordo creek watershed by first calculating the resulting direct surface runoff (DSR) for various return periods, and then modeling the hydraulic behavior of the downstream area (composed of a 178.5-m creek's reach and an existing box-culvert located at the watershed outlet) that undergoes flooding events every year. The resulting DSR increase oscillated between 8% and 19% for return periods from 5 to 100 years, and 77% for a 2-year return period when the non-stationary and stationary scenarios were compared. The results of this study shed light upon to the precautions that designers should take when selecting a design, based upon rainfall observed, as it may result in an underestimation of both the direct surface runoff and the size of the hydraulic structures for runoff and flood management throughout the city.

Publiched: Fluids, Vol. 3, 2018, pp. 27

Parámetros significativos durante los procesos de vaciado en conducciones de agua

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Resumen

El proceso de vaciado en conducciones de agua genera depresiones por la expansión del aire en el interior de las tuberías y esto podría causar el colapso del sistema dependiendo de las condiciones de instalación y de la rigidez de la conducción. En este artículo se presenta el análisis de sensibilidad del modelo matemático desarrollado por los autores, analizando los principales parámetros hidráulicos y termodinámicos que intervienen en este proceso tales como: diámetro interior de la tubería, factor de fricción, pendiente longitudinal de la tubería, coeficiente politrópico, diámetro de la ventosa, tamaño de la bolsa de aire y tiempo de apertura. Este análisis se realizó para dos casos posibles: Caso No. 1, tubería con el extremo aguas arriba cerrado; y Caso No. 2, tubería con una ventosa instalada en el extremo aguas arriba. Los resultados muestran que para el Caso No. 1 los parámetros que más inciden en las depresiones son la pendiente longitudinal de la tubería, el coeficiente politrópico y el tamaño de la bolsa de aire; mientras que para el Caso No. 2, la mayoría de los parámetros influyen significativamente durante el proceso de vaciado.

Publicación: Ingeniería del agua, Vol. 22, Nº. 3, 2018, pp. 141-152

Optimal Planning and Operation of Distribution Systems Considering Distributed Energy Resources and Automatic Reclosers

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Abstract

This paper presents an integrated methodology for planning and operation of distribution systems in an environment of smart grids. The decision variables considered are location and sizing of technologies such as: distributed generation (wind, solar and small scale hydroelectric), energy storage, protection elements for fault isolation and automatic reclosers for load transfer. The integration of these technologies enables a higher automation of the distribution system the which in turn brings advantages such as reduction in the energy and active power losses and improvement in the voltage profile and service quality. The methodology consists of three stages: i) a specialized genetic algorithm for location

of devices, ii) a particles swarm optimization algorithm for dimensioning of elements and iii) a nondominated sorting genetic algorithm to solve the multiobjective problem associated with the location of reclosers. The tests were performed on a system of 102 nodes to verify the performance of the proposed methodology.

Publiched: IEEE Latin America Transactions, Vol.16, N°. 1, 2018, pp: 126-134

Camera-Projector Calibration Methods with Compensation of Geometric Distortions in Fringe Projection Profilometry: A Comparative Study

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Abstract

The calibration methods most used in fringe projection profilometry are based on models of least squares adjustment and stereo vision techniques. However, the geometric distortions of the projector and camera lenses introduce imprecision in certain regions of the 3D reconstruction. In this paper, we perform a comparative study between the second order polynomial adjustment method and the stereo calibration method applying lens distortion compensation. The experimental results show that in the stereo calibration the incidence of the distortions in the 3D reconstruction is significant. In contrast, in the proposed polynomial calibration, reconstruction errors are associated with the calibrated volume, typically low within the calibration volume.

Publiched: Óptica Pura y Aplicada, Vol. 51, N° 3, 2018, pp. 1-10

Optimization of a Drive Shaft using PSO Algorithm

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Abstract

Mechanical design involves several continuous variables associated with the calculation of elements that compose the parts implemented in different processes. However, when the values associated with several design variables are selected, the range of each such variable may result in infinite solutions or oversized solution spaces. Thus, the choice and fit of different variables related to the mechanical parts under analysis pose a challenge to designers. This is the case of drive shaft design: the variables that represent the diameters of several transversal sections of each of its elements directly affect its weight and resistance to mechanical stresses. Therefore, the selection of variables should not be at random. This article presents the optimization of the design of a drive shaft composed of three transversal sections using the metaheuristic technique particle swarm optimization (PSO). Such problem is solved to obtain an optimal and reliable part. For that purpose, a nonlinear mathematical model was developed to represent this problem as a function of the physical features of the mechanical system. The objective function is the reduction of the weight of the shaft and the variables are the diameters of each section. The set of constraints in this problem considers the general equation to design a fatigue-safe shaft as well as a constructive constraint to establish the minimum step distance for coupling the mechanical elements. Due to the nonlinearity of the mathematical model, this work proposes PSO as optimization technique. This algorithm has proven to be an efficient tool to solve continuous nonlinear problems. Finally, the solution provided by the optimization technique is validated in ANSYS® software, thus demonstrating that the answer meets all the design criteria previously selected.

Publiched: WSEAS Transactions on Applied and Theoretical Mechanics, Vol.13, N° 13, 2018, pp. 123-129

Backflow air and pressure analysis in emptying a pipeline containing an entrapped air pocket

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Abstract

The prediction of the pressure inside the air pocket in water pipelines has been the topic for a lot of research works. Several aspects in this field have been discussed, such as the filling and the emptying procedures. The emptying process can affect the safety and the efficiency of water systems. Current research presents an analysis of the emptying process using experimental and computational results. The phenomenon is simulated using the two-dimensional computational fluid dynamics (2D CFD) and the one-dimensional mathematical (1D) models. A backflow air analysis is also provided based on CFD simulations. The developed models show good ability in the prediction of the sub-atmospheric pressure and the flow velocity in the system. In most of the cases, the 1D and 2D CFD models show similar performance in the prediction of the pressure and the velocity results. The backflow air development can be accurately explained using the CFD model.

Publiched: Urban Water Journal, Vol. 15, N° 8, 2018, pp. 769-779

Analysis and simulation of thermal / viscose model for Melt Spinning process

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Abstract

The Melt Spinning process is used for thin ribbons manufacture of amorphous materials and nanocrystalline. The material in liquid state is injected through a nozzle and solidifies upon contact with a copper rotating wheel. In this work, we intend to find, by means of a computer simulation with OpenFOAM®, a thermal profile of the material from its ejection through the nozzle to the conformation of the ribbon itself. A two-phase model of the Volume of Fluids (VOF) type is used. Although neither of the two fluids (molten metal and air) can be considered compressible for working pressures, a resolution method of a compressible nature is used. This allows to represent the density changes in the air due to temperature changes, and to define a thermo-physical model for the specific alloy. For this, we considered an alloy of constant thermal conductivity, specific heat and density. The phase change is represented by a model that relates viscosity () with temperature () in which the viscosity increases several orders of magnitude when the material passes below the crystallization temperature. Among the options of viscous models offered by OpenFOAM®, we select a polynomial model whose coefficients were determined by OCTAVE routines until achieving a fitting curve [1] for the viscosity within the temperature range of 600 to 1700°C.

Publiched: UIS Ingenierías, Volume 17, Nº 1, 2018, pp. 185-190

Fringe Quality Map for Fringe Projection Profilometry in LabVIEW

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Abstract

The phase retrieval process is mainly affected by local shadows, irregular surface brightness and fringe discontinuities. To overcome these problems, image-processing strategies are carried out such as binary masks, interpolation techniques, and filtering. Similarly, many unwrapping algorithms have been developed to handle phase unwrapping errors in two-dimensional regions. The presence of error-prone areas can be visualized during the acquisition stage avoiding the use of image processing strategies and sophisticated phase unwrapping algorithms, which in many cases represent high computational costs and long execution times. To help overcome these problems, we propose a Fringe Quality Map based on a phase residue analysis to estimate error-prone areas during acquisition. The software was fully

implemented in LabVIEW, and we provide the software as supplementary material. Experimental results demonstrate that the proposed method estimates areas with poor contrast, which lead to unwrapping errors, as well as phase errors in a more complex 3D shape.

Publiched: Óptica Pura y Aplicada, Vol. 51, N°4, 2018, pp. 50302:1-8

Quality Changes in Fundus Images of Pseudophakic Eyes

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Abstract

We consider the changes produced in the quality of eye fundus images of patients before and after cataract surgery with intraocular lens implantation and propose a measure to quantitatively assess those changes. Several factors concerning the optical system of the eye, the ocular media, and the specific characteristics of the implanted intraocular lens, may influence the quality of the digital image acquired with a non-mydriatic retinal camera. We illustrate our study with several cases taken from the clinical practice. A pair of pre- and post-operative eye fundus images represents each case. To measure image quality, we carry out a calculation of image anisotropy on each image. The results show that after surgery with intraocular lens implant, a fundus image is usually much brighter, sharp and higher quality. However, this rule of thumb can be altered by several conditions. For example, the multifocal design of the intraocular implant after a clear lens extraction. The anisotropy-based measure has revealed to be a suitable tool to quantitatively assess quality changes between pre-and post-operative fundus images.

Publiched: Óptica pura y aplicada, Vol. 51, N°4, 2018, pp. 50015:1-8

Optimal conductor size selection in radial distribution networks using a mixed-integer non-linear programming formulation

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Abstract

We consider the changes produced in the quality of eye fundus images of patients before and after cataract surgery with intraocular lens implantation and propose a measure to quantitatively assess those changes. Several factors concerning the optical system of the eye, the ocular media, and the specific characteristics of the implanted intraocular lens, may influence the quality of the digital image acquired with a non-mydriatic retinal camera. We illustrate our study with several cases taken from the clinical practice. A pair of pre- and post-operative eye fundus images represents each case. To measure image quality, we carry out a calculation of image anisotropy on each image. The results show that after surgery with intraocular lens implant, a fundus image is usually much brighter, sharp and higher quality. However, this rule of thumb can be altered by several conditions. For example, the multifocal design of the intraocular implant after a clear lens extraction. The anisotropy-based measure has revealed to be a suitable tool to quantitatively assess quality changes between pre-and post-operative fundus images.

Publiched: Óptica pura y aplicada, Vol. 51, N°4, 2018, pp. 50015:1-8

An inventory model of three-layer supply chain of wood and furniture industry in the Caribbean region of Colombia

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Abstract

This article deals with a mathematical model for multi-item inventory system under a collaborative scheme in a three-level supply chain consisting of multiple raw material suppliers, multiple manufacturers and multiple retailers in which different cycle lengths and stochastic demand and production rates are considered for the purpose of evaluating the optimal solution. The model is also validated in the supply chain of wood and furniture industry in the Caribbean region of Colombia. In the process, suppliers of raw wood (sawmills), manufacturers of home furnishings and major retailers are participated. Results include a comparison between three-level and two-level supply chains using the collaborative scheme as well as for the non-collaborative scheme among the participating members of the chain.

Publiched: International Journal of Systems Science: Operations & Logistics, Vol. 5, N°. 1, 2018, pp. 69-86

Quality Changes in Fundus Images of Pseudophakic Eyes

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Abstract

We consider the changes produced in the quality of eye fundus images of patients before and after cataract surgery with intraocular lens implantation and propose a measure to quantitatively assess those changes. Several factors concerning the optical system of the eye, the ocular media, and the specific characteristics of the implanted intraocular lens, may influence the quality of the digital image acquired with a non-mydriatic retinal camera. We illustrate our study with several cases taken from the clinical practice. A pair of pre- and post-operative eye fundus images represents each case. To measure image quality, we carry out a calculation of image anisotropy on each image. The results show that after surgery with intraocular lens implant, a fundus image is usually much brighter, sharp and higher quality. However, this rule of thumb can be altered by several conditions. For example, the multifocal design of the intraocular implant after a clear lens extraction. The anisotropy-based measure has revealed to be a suitable tool to quantitatively assess quality changes between pre-and post-operative fundus images.

Publiched: Óptica pura y aplicada, Vol. 51, N°4, 2018, pp. 50015:1-8

Optimal Power Flow on DC Microgrids: A Quadratic Convex Approximation

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Abstract

This express brief shows a convex quadratic approximation for the optimal power flow (OPF) in directcurrent microgrids () via Taylor's series expansion. This approach can be used for solving OPF problems on radial and meshed s with multiple constant power terminals, allowing to cover a wide range of configurations. Two test s with 10 and 21 nodes were used to validate the proposed model. Non-linear large-scale solvers were employed to compare the proposed linearization with the conventional nonlinear non-convex model.

Publiched: IEEE Transactions on Circuits and Systems II: Express Briefs, Article in Press, Sep 2018, pp. 1-1

Numerical Approximation of the Maximum Power Consumption in DC-MGs with CPLs via an SDP Model

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Abstract

This brief addresses the numerical approximation of the maximum power consumption in directcurrent microgrids (DC-MGs) with constant power loads through a convex optimizing model. The convex formulation is developed via a semidefinite programming model and is solved by using a MATLAB/CVX package. For comparison purposes the exact nonlinear model is solved in a GAMS package to compare the accuracy and quality of the results obtained with the proposed convex reformulation. Numerical testing is made with a small three-node DC-MG test system as well as DC-MGs from 10 to 150 nodes.

Publiched: *IEEE Transactions on Circuits and Systems II: Express Briefs*, Article in Press, Vol. 66, N° 4, April, 2019. pp. 642-646.

Application of genetic algorithm to job scheduling under ergonomic constraints in manufacturing industry

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Abstract

This research proposes a mathematical model of the problem of job rotation considering ergonomic aspects in repetitive works, lifting tasks and awkward postures in manufacturing environments with high variability. The mathematical model is formulated as a multi-objective optimization problem integrating the ergonomic constraints and is solved using improved non-dominated sorting genetic algorithm. The proposed algorithm allows the generation of diversified results and a greater search convergence on the Pareto front. The algorithm avoids the loss of convergence in each border by means of change and replacement of similar solutions. In this strategy, a single similar result is preserved and the best solution of the previous generation is included. If the outcomes are similar, new randomly generated individuals are proposed to encourage diversity. The obtained results improve the conditions of 69% of the workers. The results show that if the worker rotates starting from a high risk, his variation in risk always decreases in his next assignment. Within the job rotation scheme, no worker is exposed simultaneously to high ergonomic risk thresholds. The model and the algorithm provide good results while considering

ergonomic risks. The proposed algorithm shows the potentiality to generate a set of quality of response (Pareto Frontier) in a combinatorial optimization problem in an efficient computational time.

Publiched: Journal of Ambient Intelligence and Humanized Computing, Vol. 10, N° 5, mayo 2018, pp. 2063–2090

Incentivizing alternative fuel vehicles: the influence of transport policies, attitudes and perceptions

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Abstract

This paper aims to evaluate the influence of policies, attitudes and perceptions when incentivizing alternative fuel vehicles. The impact of possible policies such as gasoline taxes increases, purchase price subsidies, tax exemptions, and increases in fuel recharging station availability for alternative fuelled vehicles is evaluated using hybrid choice models. The models also allow assessing the sensitivity of latent variables (i.e., attitudes and perceptions) in the car purchase behaviour. The models are estimated using data from a stated choice survey collected in five Colombian cities. The latent variables are obtained from the rating of statements related to the transport system, environmental concern, vehicle preferences, and technology. The modelling approach includes regression between latent variables. Results show that environmental concern and the support for green transport policies have a positive influence on the intention to purchase alternative fuel vehicles. Meanwhile, people who reveal to be car-dependent prefer to buy standard fuelled vehicles. The analysis among cities shows similar trends in individual behaviour, although there are differences in attribute sensitivities. The policy scenario analysis revealed high sensitivity to capital cost and the need for extensive investments in refuelling stations for alternative fuel vehicles to become attractive. Nevertheless, all policies should not only be directed at infrastructure and vehicles but also be focused on user awareness and acceptance of the alternative fuel vehicles. The analysis suggests that in an environmentally conscious market, people prefer alternative fuels. However, if the transport policies support private transport, the market shares of alternative fuel vehicles will decrease.

Publiched: Transportation, Vol. 45, N° 6, Nov 2018, pp. 1721–1753

PBC Approach for SMES Devices in Electric Distribution Networks

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Abstract

This express brief presents a nonlinear active and reactive power control for a superconducting magnetic energy storage (SMES) system connected in three-phase distribution networks using pulse-with modulated current-source converter (PWM-CSC). The passivity-based control (PBC) theory is selected as a nonlinear control technique, since the open-loop dynamical model exhibits a port-Hamiltonian (pH) structure. The PBC theory exploits the pH structure of the open-loop dynamical system to design a general control law, which preserves the passive structure in closed-loop via interconnection and damping reassignment. Additionally, the PBC theory guarantees globally asymptotically stability in the sense of Lyapunov for the close-loop dynamical system. Simulation results in a three-phase radial distribution network show the possibility to control the active and reactive power independently as well as the possibility to use the SMES system connected through a PWM-CSC as a dynamic power factor compensator for time-varying loads. All simulations are conducted in MATLAB/ODE package.

Publiched: IEEE Transactions on Circuits and Systems II: Express Briefs, Vol. 65, N° 12, Dic 2018, pp. 2003–2007

Stability Analysis of Single-Phase Low-Voltage AC Microgrids with Constant Power Terminals

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Abstract

This express brief presents the stability analysis of single-phase microgrids (SP-MG) operating under master–slave connection with constant power terminals. The SP-MG is composed of linear elements, nonlinear loads, and distributed generators modeled as PQ constant terminals interconnected through power electronic converters. Lyapunov's direct method through a Hamiltonian representation of the grid is used to demonstrate stability. The non-autonomous model of the SP-MG is transformed into an autonomous equivalent model based on the dynamics of the error. The proposed analysis shows that if there is an admissible trajectory x solution of the power flow equations, then the SP-MG is stable in the sense of Lyapunov.

Publiched: IEEE Transactions on Circuits and Systems II: Express Briefs, Article in Press, pp. 1-1

Transient phenomena during the emptying process of a single pipe with water-air interaction

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Abstract

Emptying pipelines can be critical in many water distribution networks because subatmospheric pressure troughs could cause considerable damage to the system due to the expansion of entrapped air. Researchers have given relatively little attention to emptying processes compared to filling processes. The intricacy of computations of this phenomenon makes it difficult to predict the behaviour during emptying, and there are only a few reliable models in the literature. In this work, a computational model for simulating the transient phenomena in single pipes is proposed, and was validated using experimental results. The proposed model is based on a rigid column to analyse water movement, the air–water interface, and air pocket equations. Two practical cases were used to validate the model: (1) a single pipe with the upstream end closed, and (2) a single pipe with an air valve installed on the upstream end. The results show how the model accurately predicts the experimental data, including the pressure oscillation patterns and subatmospheric pressure troughs.

Publiched: Journal of Hydraulic Research, Article in press, Ago 2018

Anuario de Investigaciones 2018

FACULTAD DE CIENCIAS BÁSICAS

Anatomical Pathology of the Umbilical Cord and Its Maternal and Fetal Clinical Associations in 434 Newborns

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Abstract

Introduction Umbilical cord (UC) abnormalities and their clinical relations in 434 newborns were analyzed. We had previously reported on clinical associations of long and short UCs with any kind of malformation. This study focuses on other UC features (insertion, vessels, entanglements, coiling, and knots) and their associations with clinical characteristics and neonatal prognosis. Methods An observational analytic study was performed on placentas from consecutive deliveries. Ordered logistic regression with bivariate and multivariate analysis was performed to evaluate the relationship between variables of interest concerning UC abnormalities. Results A total of 434 placentas made up the study. UC abnormalities were abnormal insertion, 82 (18.86%); coiling (hypo and hypercoiled), 177 (40.78%); single umbilical artery (SUA), 4 (0.92%); entanglements, 8 (1.84%); true knots, 3 (0.69%); webs in UC base, 9 (2.07%); and right twist, 68 (15.67%). After analyzing maternal and fetal complications during pregnancy, multivariate analysis confirmed the recognized association between malformations and SUA and male gender; further confirmation was also made between hypertensive disorders of pregnancy and true knots. Discussion UC abnormalities associated with undesirable outcomes are varied and should be recognized and described. Clinical factors associated with anatomical UC abnormalities are not completely understood and justify forthcoming studies.

Publiched: Pediatric and Developmental Pathology, Vol. 21, N° 5, 2018, pp. 467–474

Semiclassical self-consistent treatment of the emergence of seeds of cosmic structure. The second order construction

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Abstract

In this work we extend the results of [1] where, Semiclassical Selfconsistent Configurations (SSC) formalism was introduced. The scheme combines quantum field theory on a background space-time, semiclassical treatment of gravitation and spontaneous collapse theories. The approach is applied to the context of early universe cosmology using a formal description of the transition from an initial inflationary stage characterized by a spatially homogeneous and isotropic (H&I) universe, to another where inhomogeneities are present in association with quantum fluctuations of the field driving inflation. In that work two constructions are produced. One of them describes a universe that is

completely spatially homogeneous and isotropic, and the other is characterized by a slight excitation of the particular inhomogeneous and anisotropic perturbation. Finally, a characterization of their gluing to each other is provided as representing the transition as a result from a spontaneous collapse of the state of the quantum field, following the hypothesis originally introduced in [2]. Specifically, in [1] this construction is carried out by using cosmological perturbation theory and working up to linear order in the perturbation. However, given the nonlinear nature of gravitation, we should in principle explore the application of the formalism in a nonlinear regime. To this end and as a first step, we study in this work the transition from a spatially homogeneous and isotropic (H&I) Semiclassical Self-Consistent Configuration (SSC-I) to one SSC-II that is not spatially (H&I), working this time up to second order in perturbation theory. We find that the self-consistent construction now requires consideration of the so called tensor modes, as well as a nontrivial mixing of modes that made the analysis much more difficult and which could not a priori be warranted to work out in detail. The present work shows that this is indeed the case.

Publiched: Journal of Cosmology and Astroparticle Physics, Vol. 08, 2018, pp. 1 - 50

Topological Invariants of Principal G-Bundles with Singularities

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Abstract

Principal G-bundle with singularities is a principal bundle π : $P^- \to M$ with structure group G^- which reduces to a subgroup $G \subseteq G^-$ on the set $M \setminus \Sigma$, where M is an n-dimensional compact manifold and $\Sigma \subseteq M$ is a k-dimensional submanifold. For example, a vector field on an n-dimensional Riemannian manifold M defines reduction of the orthonormal frame bundle of M to the subgroup $O(n-1) \subseteq O(n)$ on the set $M \setminus \Sigma$, where Σ is the set of zeros of this vector field. The aim of this paper is to construct topological invariants of principal bundles with singularities. To do this we apply the obstruction theory to the section $M \to P^-/G$ corresponding to the reduction and obtain the topological invariant as a class in $Hn^-k(M, M \setminus \Sigma; \pi n - k - 1(G^-/G))$. We study the properties of this invariants and, in particular, consider cases k = 0 y k = n - 1.

Publiched: Lobachevskii Journal of Mathematics, Vol. 39, N° 5, 2018, pp 623-633

Ecotoxicological assessment of perchlorate using in vitro and in vivo assays

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Abstract

Perchlorate is an inorganic ion widespread in the environment, generated as a natural and anthropogenic pollutant, with known endocrine disruption properties in the thyroid gland. Nonetheless, there are few reports of its ecotoxicological impact on wildlife. The aim of this study was to evaluate the adverse effects of KClO4 exposure on different cell lines, HEK, N2a, and 3T3, as well as in ecological models such as Vibrio fischeri, Pseudokirchneriella subcapitata, Daphnia magna, and Eisenia fetida. Perchlorate exhibited similar toxicity against tested cell lines, with LC50 values of 19, 15, and 19 mM for HEK, N2a, and 3T3, respectively; whereas in V. fischeri, the toxicity, examined as bioluminescence reduction, was considerably lower (EC50 = 715 mM). The survival of the freshwater algae P. subcapitata was significatively impaired by perchlorate (LC50 = 72 mM), and its effect on the lethality in the crustacean D. magna was prominent (LC50 = 5 mM). For the earthworm E. fetida, the LC50 was 56 mM in soil. In this organism, perchlorate induced avoidance behavior, weight loss, and decreased egg production and hatchling, as well as morphological and histopathological effects, such as malformations, dwarfism, and necrosis. In conclusion, perchlorate toxicity varies according to the species, although E. fetida is a sensitive model to generate information regarding the toxicological impact of KClO4 on biota.

Publiched: Environmental Science and Pollution Research, Volume 25, N° 14, pp 13697–13708

A no-hair theorem for black holes in f® gravity

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Abstract

In this work we present a no-hair theorem which discards the existence of four-dimensional asymptotically flat, static and spherically symmetric or stationary axisymmetric, non-trivial black holes in the frame of f^{0} gravity under metric formalism. Here we show that our no-hair theorem also can discard asymptotic de Sitter stationary and axisymmetric non-trivial black holes. The novelty is that this no-hair theorem is built without resorting to known mapping between f^{0} gravity and scalar-tensor theory. Thus, an advantage will be that our no-hair theorem applies as well to metric f^{0} models that cannot be mapped to scalar-tensor theory.

Publiched: Classical and Quantum Gravity, Vol. 35, N° 2, 2018, Article ID. 025018

Black hole-wormhole transition in (2 + 1)-dimensional Einstein-anti-de Sitter gravity coupled to nonlinear electrodynamics

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Abstract

In this paper we present two results in (2+1) gravity coupled to nonlinear electrodynamics. First we determine the general form of the electromagnetic field tensor in (2+1) gravity coupled to nonlinear electrodynamics in stationary cyclic spacetimes. Secondly, we determine a family of exact solutions in (2+1) gravity sourced by a nonlinear electromagnetic field. The solutions are characterized by five parameters: mass M, angular momentum J, cosmological constant Λ , and two electromagnetic charges q α and q β . Remarkably, the solution can be interpreted as a traversable wormhole, provided the fulfillment of certain inequalities by the characteristic parameters; fine-tuning of the cosmological constant leads to an extreme black hole, whereas by switching off one of the electromagnetic charges, we obtain the Bañados-Teitelboim-Zanelli (BTZ) black hole.

Publiched: Physical Review D, Volume 98, N°, 2018

An a Posteriori Error Estimator for a Non-Conforming Domain Decomposition Method for a Harmonic Elastodynamics Equation

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Abstract

We present and analyze an a posteriori error estimator based on mesh refinement for the solution of the hypersingular boundary integral equation governing the Laplacian in three dimensions. The discretization under consideration is a nonconforming domain decomposition method based on the Nitsche technique. Assuming a saturation property, we establish quasireliability and efficiency of the error estimator in comparison with the error in a natural (nonconforming) norm. Numerical experiments with uniform and adaptively refined meshes confirm our theoretical results.

Publiched: East Asian Journal on Applied Mathematics, Vol. 8, 2018, pp. 365-384

Anuario de Investigaciones 2018

FACULTAD DE CIENCIAS SOCIALES Y HUMANIDADES

Parental competences and child resilience in the context of displacement in Colombia

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Abstract

This paper presents results of a research that arose from the interest of studying the phenomenon of forced displacement as an adversity, which can be overcome because human beings have the competences to mitigate psychosocial damages after living a shocking situation. The study aimed to establish relationships between the competences of fathers and mothers, the support they seek in the community and resilience factors in infants exposed to the armed conflict in a region of the Colombian Caribbean. Through a quantitative - correlative methodology, scales and inventories were applied to 230 families. The results showed a positive relationship between community integration and the ability of parental figures to guide infants. A positive relationship was found between the capacity of the parental figures to plan free time and the ability of children to understand the feelings and ideas of others. These results suggest lines of action in social programs aimed at strengthening family resources, achieving the difficult reparation of the victims and finding the desired national reconciliation in moments of post-agreement.

Publiched: Prisma Social, N°. 20, 2018, pp. 227-253

Approaching Resilience for Climate Change Adaptation in Complex Milieus: The Case of Vulnerable Neighborhoods in Cartagena de Indias

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Abstract

Tackling related climate change impacts and extreme weather events in urban areas located in developing countries is increasingly becoming a challenge for several stakeholders. Responses to such impacts are being framed and addressed by strategies and policies under the climate change adaptation and mitigation frameworks. However, approaching resilience and adaptive capacities are ever more in need in complex neighborhoods, especially when these are facing climate impacts such as flooding. Framing social dimensions into that adaptive capacity in complex urban systems characterized by poverty, exclusion and the poor public services access makes harder their living standards. Thereby, frameworks taking into account social elements and key indicators of inclusiveness, contribute to the understanding of the social fabrics based on the living conditions of disadvantaged localities.

Publiched: European Journal of Sustainable Development, Vol. 7, N° 3, 2018, pp. 255-264

La prensa colombiana y el galeón San José: un interés político y jurídico pero no numismático

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Resumen

Se presenta en este artículo de reflexión el escaso interés de la prensa colombiana ante el patrimonio numismático encontrado en el año 2015 en el pecio del galeón San José, navío de guerra hundido en Barú (cercanías de Cartagena de Indias) en el año 1708. Las opiniones del Reino de España sobre sus supuestos derechos jurídicos como propietario de las monedas que el barco transportaba han fomentado, en varios periódicos colombianos, la bandera del antiespañolismo, una situación que afortunadamente parece ya superada.

Publicación: Revista Numismática, N°5, pp. 181-189

Anuario de Investigaciones 2018

FACULTAD DE ECONOMÍA Y NEGOCIOS

Organizational cynicism - An exploration analysis-case: Workers in the city of Cartagena de Indias

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Abstract

Organizational cynicism is a fact that is present and negative within organizations. In this sense, the present study aims to approach the phenomenon of cynicism in organizations from the study of cynical attitudes composed by cynical ideas, behaviors and emotions on a behavioral scale. The research carried out on an exploration level has allowed to evidence that in Colombia, and particularly in the city of Cartagena de Indias, there is a presence of cynical attitudes by the workers.

Publiched: Espacios, Vol. 39, N°. 26, 2018, Article Number. 27

Anuario de Investigaciones 2018

CONFERENCE PAPERS

Nonlinear Analysis for the Three-Phase PLL: A New Look for a Classical Problem

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Abstract

In this paper we investigate the dynamics of the classic synchronous reference frame phase-locked-loop (PLL) from a non-linear perspective. First, we demonstrate the non-linear differential equations that describe the PLL under balanced conditionscan be represented as a dissipative Hamiltonian system (DHS). After that, we find the equilibrium points of this system and their stability properties. Additional properties are investigated such as the attraction region, the conditions for exponential stability and the performance for small unbalances and/or transients in the grid. Simulations results complement the theoretical analysis. We not propose a new type of PLL, instead, we propose a non-linear analysis for the classic synchronous reference frame PLL. This analysis is useful for theoretical and practical studies since this PLL is widely used in industrial applications. In addition, itcan give insights for better understanding of the dynamics of the phase-locked-loop1.

Publiched: 2018 IEEE 19th Workshop on Control and Modeling for Power Electronics, 25 - 28 junio, 2018

Apparent power control in single-phase grids using SCES devices: An IDA-PBC approach

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Abstract

This paper proposes a passivity-based control (PBC) applied to a supercapacitor energy storage system (SCES) with a single-phase pulse-width-modulated voltage source converter (VSC). The proposed strategy allows to control the interchange of active and reactive power between SCES and the distribution network using its natural reference frame. It also guarantees closed-loop stability in the sense of Lyapunov via a Hamiltonian formulation. Simulation results demonstrate the efficiency and robustness of the proposed control applied on a low-voltage single-phase distribution network under different operative conditions.

Publiched: 9th IEEE Latin American Symposium on Circuits and Systems, LASCAS 2018 – Proceedings, 25-28 febrero, 2018

Passivity-based control for battery charging/discharging applications by using a buck-boost DC-DC converter

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Abstract

In this paper, a passivity-based control (PBC) theory is applied to control a battery energy storage system (BESS) under current control mode by employing a bidirectional buck-boost DC-DC converter. The proposed controller guarantees globally exponentially stability for the system under closed-loop conditions via proportional control design. An averaging model of the buck-boost DC-DC converter is employed to represent the dynamics of the system via port-Hamiltonian (pH) structure. Simulation results show that a unique control law can be used to the charging or discharging battery process. MATLAB/SIMULINK software is employed to validate the proposed control methodology.

Publiched: 2018 IEEE Green Technologies Conference (Green Tech), 4-6 abril, 2018

Nonlinear control for battery energy storage systems in power grids

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Abstract

This paper presents a nonlinear control strategy to integrate Battery Energy Storage Systems (BESS) in electrical power systems connected through Voltage Source Converters (VSCs). Exact feedback linearization control technique based on the dynamical model of the system is employed as control strategy. Two VSCs topologies are proposed to control the generated/consumed current by the BESS. The proposed controller allows the charge/discharge of the BESS with either constant current or constant power. The VSC is employed to independently compensate for the active and reactive power from/to the grid to/from the BESS. A radial distribution network modeled in MATLAB/SIMULINK is implemented as a test system to validate the functionality of the controller under two scenarios.

Publiched: 2018 IEEE Green Technologies Conference (GreenTech), 4-6 abril, 2018

Current control mode in PV systems integrated with DC-DC converters for MPPT: An IDA-PBC approach

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Abstract

In this paper, an interconnection and damping assignment passivity-based control (IDA-PBC) theory is employed to obtain maximum power point tracking (MPPT) for a photovoltaic (PV) module. A current control mode is selected to obtain the general control law, which guarantees exponential stability of the system in the sense of Lyapunov. The current is selected as the objective of control in this paper, due to the variations of irradiance and temperature on the PV module to produce the most impact in the current provided by the panel in comparison with its voltage profile. A modification of the classical IDA-PBC theory is employed to control the dynamical system under trajectory tracking. Simulation results show the capacity of the proposed control to extract the maximum power from the PV module under high changes in the irradiance and temperature. All simulations are conducted in MATLAB/Simulink.

Publiched: 2018 IEEE Green Technologies Conference (GreenTech), 4-6 abril, 2018

Microscopic shape from focus using white light interferometric fringes

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Abstract

In this work we study the use of a focus measure to improve the 3D reconstruction of low reflectivity microscopic samples using white light interference microscopy. Simulation and experimental results show the improved reconstruction.

Publiched: Optics InfoBase Conference Papers, 11-15 marzo, 2018

Object-oriented mathematical modeling for estimating electric vehicle's range using modelica

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Abstract

Electric vehicles (EVs) offer a great alternative for decar-bonizing the transport sector. However, insufficient recharging infrastruc-ture and limited range increase the driver's 'range anxiety'. Furthermore, the autonomy information provided by vehicle manufacturers differs from the range obtained under real-driving conditions. In order to estimate the actual range of an EV under different driving profiles, accurate computational modeling is required. This paper presents a library for modelingand simulating EVs using the object-oriented modeling language Mod-elica that allows calculating the energy consumption and the impact of different driving behaviors on the vehicle's driving range. Each vehicle'smodel only requires generic parameters that can be obtained from the vehicle's manufacturer's specification sheet. The parameters of the exam-ple models have been calibrated using vehicle parameters found in the literature for several commercial vehicles.

Publiched: Communications in Computer and Information Science, Agoto 2018, pp 444-458

Failures Monitoring in Refrigeration Equipment

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Abstract

The refrigerators are the responsible to assure the temperature and humidity conditions for perishable products stored in it. In this sense, it is necessary to guarantee its good performance at all times in order to preserve the products. In this article we propose a failures monitoring system for refrigeration equipment using Internet of Things (IoT) technologies. The aim of the solution is to manage preventive and corrective maintenance programs and, in this way, we look for assuring the conditions of the consigned products that are distributed along an entire country. We present the conceptualization, the design of the system and the results of the proof of concept.

Publiched: Communications in Computer and Information Science, Vol. 916, Sep 2018, pp. 136-146

Instrumented insole for plantar pressure measurement in sports

Authors: Iván Echeverry Mensera, William Bautista Aguiar, Diego Florez Quintero, Dayana Narváez Martínez, Sonia Contreras Ortiz Contact: Facultad de Ingeniería, Universidad Tecnológica de Bolívar scontreras@utb.edu.co

Abstract

Novel technological aids have been developed to evaluate sport performance. Among these tools there are wearable sensors that monitor physical and physiological variables during the execution of exercises. This paper describes the design and construction of an instrumented insole for acquisition and transmission of plantar pressure. The system was designed to support heavy weights, such as in weightlifting. It uses five high-range force sensors located in relevant anatomical points. It can be worn comfortably by the athlete and plantar pressure can be transmitted wirelessly to be registered and visualized in real-time.

Publiched: Communications in Computer and Information Science, Vol. 885, Ago 2018, pp. 252-259

A structure-from-motion pipeline for topographic reconstructions using unmanned aerial vehicles and open source software

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Abstract

In recent years, the generation of accurate topographic reconstructions has found applications ranging from geomorphic sciences to remote sensing and urban planning, among others. The production of high resolution, high-quality digital elevation models (DEMs) requires a significant investment in personnel time, hardware, and software. Photogrammetry offers clear advantages over other methods of collecting geomatic information. Airborne cameras can cover large areas more quickly than ground survey techniques, and the generated Photogrammetry-based DEMs often have higher resolution than models produced with other remote sensing methods such as LIDAR (Laser Imaging Detection and Ranging) or RADAR (radar detection and ranging).

In this work, we introduce a Structure from Motion (SfM) pipeline using Unmanned Aerial Vehicles (UAVs) for generating DEMs for performing topographic reconstructions and assessing the microtopography of a terrain. SfM is a computer vision technique that consists in estimating the 3D

coordinates of many points in a scene using two or more 2D images acquired from different positions. By identifying common points in the images both the camera position (motion) and the 3D locations of the points (structure) are obtained. The output from an SfM stage is a sparse point cloud in a local XYZ coordinate system. We edit the obtained point in MeshLab to remove unwanted points, such as those from vehicles, roofs, and vegetation. We scale the XYZ point clouds using Ground Control Points (GCP) and GPS information. This process enables georeferenced metric measurements. For the experimental verification, we reconstructed a terrain suitable for subsequent analysis using GIS software. Encouraging results show that our approach is highly cost-effective, providing a means for generating high-quality, low-cost DEMs.

Publiched: Communications in Computer and Information Science, Vol. 855, Ago 2018, pp. 213-225

Optimal Location of Protective Devices Using Multi-Objective Approach

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Abstract

In this paper a multi-objective model for the problem of optimal location of reclosers and fuses in power electric distribution systems is presented, considering the possibility of fuse rescue through the coordinated operation with reclosers and continuous operation with fuses of repetition. The problem is presented based on a mixed integer non-linear programming model with four objectives of minimization: Average System Interruption Frequency Index (ASIFI), System Average Interruption Frequency Index (SAIFI), Momentary Average Interruption Frequency Index (MAIFI) and the cost of the protective elements, and a set of non-linear technical and economic constraints. A Non-dominated Sorted Genetic Algorithm (NSGA II) is used as solution technique. In addition to this, the mathematical model presented for the MAIFI and SAIFI indices, is evaluated in the commercial optimization package of GAMS, in order to meet a global optimum from the one-objective point of view. The methodology proposed is assessed in two test systems from the literature highlight the efficiency of the presented model in improving system reliability while reducing associated costs.

Publiched: Communications in Computer and Information Science, Vol. 916, Sep 2018, pp. 3-15

Mathematical model for assigning an optimal frequency of buses in an integrated transport system

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Abstract

This paper proposes a mathematical model to estimate the frequency setting of the buses for a specific route on any given hour in public transportation systems. This model can be used for three different purposes: determine how many buses a route needs to fully satisfy its demand, estimate an optimal bus frequency to satisfy the maximum amount of demand when the number of buses is fixed and estimate an optimal bus frequency to satisfy a given percentage of demand. It receives three entries: number of buses assigned to the route, which can vary or not depends on its purpose, the travel time for the route and the route's demand. A series of equations are proposed using a heuristic method, which allows calculating the frequency of a route at any given hour of the day.

A use case experiment is applied to help understand how to use the model on it's different suggested uses. Additionally, exposes how the proposed model could improve an actual one. The results of this experiment case showed that the demand could be fulfilled using one of this model's cases.

Publicación: Communications in Computer and Information Science, Vol. 885, Ago 2018, pp 70-82

HoloEasy, a web application for computer generated holograms

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Abstract

If the appropriate phase and/or amplitude profile is placed on a Diffractive Optical Element (DOE) it can practically generate an image of an object (hologram) by diffraction of the light. The problem of generating computer holograms consists of calculating numerically the profile of phase and/or amplitude with which the DOE should be built. Computer Generated Holograms (CGH) can be used to construct general-purpose optical elements in the sense that they serve to transform a spatial distribution of light into any other. In this way, they are used in optical communication systems, laser machining, laser welding, optical readers, human vision, data storage and visualization, image processing, among others. Unlike the optical techniques for generating holograms, in the CGH both the desired image and the phase and/or amplitude distribution are calculated numerically. In this work, a web environment application has been developed to calculate the phase changes that a coherent beam of

light must undergo when incident on a DOE, so that it is transformed by Fraunhofer diffraction, in the hologram of an object. We use an algorithm with iterative Fourier transformations (IFTA) that uses regulation and stabilization parameters can be chosen by the user. In addition, the user has the freedom to choose holograms for optical applications (free of speckles) generating initial diffusers of a limited band and without phase singularities.

Publiched: Communications in Computer and Information Science, Vol. 885, Ago 2018, pp. 471-486

Hierarchical agglomerative clustering of time-warped series

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Abstract

We have developed a procedure for hierarchical agglomerative clustering of time series data. To measure the dissimilarity between these data, we use classically the Euclidean distance or we apply the costs of the series nonlinear alignment (time warping). In the latter approach, we use the classical costs or the modified ones. The modification consists in matching short signal segments instead of single signal samples. The procedure is applied to a few datasets from the internet archive of time series. In this archive, the series of the same classes possess visual similarity but their time evolution is often different (the characteristic waves have different location within the individual signals). Therefore the use of the Euclidean distance as the dissimilarity measure gives poor results. After time warping, the nonlinearly aligned signals match each other better, and therefore the total cost of the alignment appears to be a much more effective measure. It results in higher values of the Purity index used to evaluate the results of clustering. In most cases, the proposed modification of the alignment costs definition leads to still higher values of the index.

Publiched: Advances in Intelligent Systems and Computing, Vol. 659, sep 2017, pp. 207-216

Evaluating the influence of camera and projector lens distortion in 3D reconstruction quality for fringe projection profilometry

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Abstract

We study the influence of geometric distortions of the camera and projector lenses on 3D reconstruction quality for fringe projection profilometry. Experimental results on real objects and their 3D models show the accuracy is improved.

Publiched: Optics InfoBase Conference Papers, 25-28 junio, 2018

An automatic approach to generate corpus in Spanish

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Abstract

A corpus is an indispensable linguistic resource for any application of natural language processing. Some corpora have been created manually or semi-automatically for a specific domain. In this paper, we present an automatic approach to generate corpus from digital information sources such as Wikipedia and web pages. The information extracted by Wikipedia is done by delimiting the domain, using a propagation algorithm to determine the categories associated with a domain region and a set of seeds to delimit the search. The information extracted from the web pages is carried out efficiently, determining the patterns associated with the structure of each page with the purpose of defining the quality of the extraction.

Publiched: Communications in Computer and Information Science, Vol. 885, Ago 2018, pp. 150-161

Thermoeconomic Analysis Of Pvc Production Plant Reactors Cooling System

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Abstract

In this work the results of the research made to PVC production plant reactors cooling system are included. The heat generated in the reactor must be removed to maintain its temperature at an optimal range between 50 and 70 ° C. To assess the cooling system exergetic and Thermoeconomic indicators were used and it was observed that: (i) The greatest exergetic efficiencies arise in compressors. (ii) The greatest destruction of exergy and reasons of destruction of exergy cost and lower exergoeconomic factors are presented in the evaporative condenser. (iii) The heat exchange equipment has highest relative cost differences.

Publiched: ASME International Mechanical Engineering Congress and Exposition, Vol. 6, 3-9 noviembre, 2017, pp. V006T08A073

Analysis and Classification of Evoked Potentials in Response to Familiar and Unfamiliar Faces

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Abstract

Brain activity during perception and recognition of faces have been studied by researchers with the purpose to develop brain-computer interfaces and to study neurological disorders. In this paper, we analyzed evoked potentials as neurophysiological indicators and developed a model based on signal processing and machine learning techniques to find descriptive patterns that allow the differentiation of familiar and unfamiliar faces. We considered wave components such as P1, N170, N250, P300, and N400 to describe the events. Morphological analysis and wavelet transform were used for the feature extraction stage, and support vector machines and binomial logistic regression were evaluated for the classification stage. The best classification results were obtained with the morphological characteristics, where the highest classification accuracy was 80% on average.

Publiched: 2018 IEEE ANDESCON, ANDESCON, 22-24 agosto, 2018

Wirtinger's Calculus for the Load Flow in Power Distribution Grids

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Abstract

This paper shows a Wirtinger's-Calculus based load-flow methodology for power distribution grids. This approach allows to obtain an algorithm which works directly on the complex domain maintaining some useful symmetries and a compact representation. The paper aims to introduce Wirtinger's Calculus as a suitable tool for power systems analysis; therefore, it is presented as a tutorial, playing especial attention on the implementation in modern scrip languages such as Matlab/Octave, which allow easy representation and fast complex-array calculations. A Newton's-based method is proposed in which the Jacobian is replaced by Wirtinger's derivatives obtaining a compact representation. Simulation results complement the analysis. Despite being a mature theory, Wirtinger's-Calculus has not been applied before in this type of problems.

Publiched: 2018 IEEE ANDESCON, ANDESCON, 22-24 agosto, 2018

Small-Signal Stability in Low-Voltage DC-Grids

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Abstract

This paper presents a general methodology for small signal stability analysis in low voltage de grids considering four type of terminals, namely: constant power, constant voltage, constant current and constant impedance. This methodology is useful for academic purposes but also in practical applications which includes dc-distribution and dc-microgrids. Simulation results demonstrated the proposed small signal model is accurate compared to dynamical simulations.

Publiched: 2018 IEEE ANDESCON, ANDESCON, 22-24 agosto, 2018

Group-Theory for the Analysis of Heuristic Algorithms in Power Distribution Systems

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Abstract

This paper applies group theory to four classic problems in power distribution systems, namely: phase balancing, primary feeder reconfiguration, optimal tap setting of voltage regulator transformers and optimal placement of fixed capacitors. The main focus of the paper is in the codification and the use of groups as a tool for analysis. A simple random search algorithm is used as a test for the first problem. It is demonstrated that the groups formalism allows a simple analysis of heuristics and could be an interesting path for future investigations.

Publiched: 2018 IEEE PES Transmission and Distribution Conference and Exhibition - Latin America, T and D-LA, 18-21 Septiembre, 2018

SCES Integration in Power Grids: A PBC Approach under abc, $\alpha\beta0$ and dq0 Reference Frames

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Abstract

This paper presents an integration of three-phase supercapacitor energy storage (SCES) in power grids via passivity-based control (PBC) theory under different reference frames. The SCES systems have the possibility to interchange active and reactive power between the supercapacitor and converter to the electrical power network. The active power is directly related to the energy stored on the supercapacitor, while the reactive power is redistributed by the forced commutated switches present in the voltage source converter (VSC) used to integrate the SCES system to the power grid. PBC theory allows designing Lyapunov stable controllers for autonomous and non-autonomous dynamical systems via port-Hamiltonian (pH) representations. The averaging modeling theory employs to develop the controllers under abc, $\alpha\beta$ and dq reference frames. Simulation results show the possibility of using the SCES devices to compensate active and reactive power in power grids dynamically in all operating quadrants. All simulations are conducted via MATLAB/SIMULINK software.

Publiched: 2018 IEEE PES Transmission & Distribution Conference and Exhibition - Latin America (T&D-LA), 18-21 Septiembre, 2018

A particle swarm optimization approach to log-gabor filtering in fourier transform profilometry

Authors: Jesús Pineda, Jhacson Meza, Andrés G. Marrugo, Raúl Vargas, Lenny A. Romero Contact: Facultad de Ingeniería, Universidad Tecnológica de Bolívar agmarrugo@utb.edu.co

Abstract

In this work, we propose a particle Swarm Optimization approach to Log-Gabor filtering in Fourier transform profilometry. Encouraging experimental results show the advantage of the proposed method.

Publiched: Latin America Optics and Photonics Conference, 12-15 noviembre 2018

Adaptive filtering of interference fringes by polar transformation and empirical mode decomposition

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Abstract

We designed an adaptive filter based on empirical mode decomposition for the removal of fringes in an interference microscopy image. Promising results show the possibility for extended depth-of-field imaging.

Publiched: Latin America Optics and Photonics Conference, 12-15 noviembre, 2018

An experimental study on deformation analysis of an indented pipe via fringe projection profilometry and digital image correlation

Authors: Nelson Forero, Andrés G. Marrugo, Raúl Vargas, Jesús Pineda, Jairo Useche, Lenny A. Romero Contact: Facultad de Ingeniería, Universidad Tecnológica de Bolívar apatino@utb.edu.co

Abstract

We studied the surface displacement of a steel pipe during indentation via Fringe Projection Profilometry and 2D-Digital Image Correlation. Experimental results show that a 3D strain approximation is possible for comparison with numerical simulation.

Publiched: Latin America Optics and Photonics Conference, 12-15 noviembre, 2018

Experiences with the use of Snap Circuits and Arduino boards as tools for human development with students in an insular Colombian community

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Abstract

Insular communities in Colombia have had significant lags in human development. As a strategy to help overcome these shortcomings, this paper proposes the use of technological tools such as Snap Circuits and Arduino boards. The results obtained in the first phase of the research show that this type of technology succeeds in attracting secondary school students and contributes to the generation of capacities. It should also be noted that, in order to positively impact the human development indices of these populations, a long-term effort is required that also addresses different dimensions and strategies.

Publiched: LACCEI international Multi-conference for Engineering, Education and TeCHIology, 18-20 julio, 2018

Análisis de viscocidad en lubricantes mediante diseño factorial con tres factores

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Resumen

En el campo de la estadística, el diseño experimental se convierte en una herramienta de análisis para establecer las condiciones ideales de un proceso y/o producto muy importante, el análisis de varianza es muy útil en los casos en que se cuentan con una serie de factores controlables y que afectan un proceso complejo con el objetivo de optimizarlas, en el caso puntual, se busca darle una solución a un análisis de lubricantes utilizando un diseño factorial. Para el desarrollo del siguiente documento se plantea mostrar el análisis realizado a muestras de lubricante mediante diseño factorial 3x22 con 9 réplicas. El análisis se realizó a 108 muestras, teniendo en cuenta tres tipos diferentes de lubricantes; los cuales fueron sometidos a una temperatura de 40 grados centígrados mediante prueba de viscosidad cinemática. Se pudo observar en el análisis que teniendo en cuenta los factores que interactuaban en el diseño (tipos de lubricante, partes, marcas), solo uno de ellos mostro interacción significativa. Se plantea pertinente el uso del diseño de experimentos factorial, ya que este puede ser útil en la toma de decisiones de mantenimiento al momento de comprar de una marca de lubricante especifica. El diseño de experimento fue llevado a cabo con el software estadístico StatGraphics.

Publicación: LACCEI international Multi-conference for Engineering, Education and TeCHIology, 19-21 julio, 2018

Differential diagnosis of dengue and chikungunya in colombian children using machine learning

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Abstract

Dengue and chikungunya are vector borne diseases endemic in tropical countries around the world, with very similar clinical presentation, which makes it hard for physicians to tell them apart. Here we propose the use of Machine Learning based classifiers to perform differential diagnosis of dengue and chikungunya in pediatric patients, using simple blood test results as predictors instead of symptoms. Three variables (platelet count, white cell count and hematocrit percentage) from 447 pediatric patients

from Hospital Infantil Napoleón Franco Pareja were collected to construct a dataset, later partitioned into train and test sets using Stratified Random Sampling. Grid Search with Stratified 5-Fold Cross-Validation was conducted to assess the performance of Logistic Regression, Support Vector Machine, and CART Decision Tree classifiers. Cross-Validation results show a L2 Logistic Regression model with second degree polynomial features outperforming the other models considered, with a cross-validated Receiver Operating Characteristic Area Under the Curve (ROC AUC) score of 0.8694. Subsequent results over the test set showed a 0.8502 ROC AUC score. Despite a reduced sample and a heavily imbalanced data set, ROC AUC score results are promising and support our approach for dengue and chikungunya differential diagnosis.

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A parametric sensitivity analysis of numerically modelled piston-type filling and emptying of an inclined pipeline with an air valve

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Abstract

Filling and emptying operations should be planned by engineers in operational stages to prevent a system failure depending on reaching extreme low pressure values. In this sense, a compression of an air pocket produces pressure surges, while an expansion generates troughs of subatmospheric pressure. A sensitivity analysis of main hydraulic and thermodynamic parameters was conducted based on a mathematical model developed by the authors. A case study was selected to see the influence of different parameters. When the filling operation is performed, the more sensible parameters are pipe slope, air valve size, internal pipe diameter, and friction factor; while, the emptying operation shows that air valve size, air pocket size, pipe slope, and internal pipe diameter are the more sensible parameters.

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Exact galactic disk-haloes model in Einstein-Maxwell gravity

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Abstract

An exact model in Einstein-Maxwell gravity describing a magnetized galactic disk-halo system is presented. The description of properties of the stationary metric and its source are discussed. All the expressions are presented in terms of an Harmonic function. A "generalization" of the Kuzmin potential is used as a particular example. The solution obtained is asymptotically Minkowskian in general and turns out to be singularity free. All the relevant quantities show a reasonable physical behavior.

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CFD and 1D simulation of transient flow effect on air vessel

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Abstract

The estimation of unsteady parameters in two-phase condition is crucial for the safety and reliability of the hydraulic systems. There are plenty of one-dimensional (1D) simulation tools for unsteady flow estimation being some of them able to present good results in monophasic flows, while almost all of them are not suitable for two-phase flows. In this research, an experimental apparatus including valves, pipes and an air vessel is used to fulfil the experiments. A mathematical formulation and a two-dimensional computational fluid dynamics (2D CFD) model have been used to predict the extreme conditions. Results show that 1D model is able to predict pressure values with acceptable accuracy. However, the 2D CFD model can be used to detect the specialized problems in a system by providing very high range of the information.

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Motion of test particles in a magnetized conformastatic background

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Abstract

A class of exact conformastatic solutions of the Einstein-Maxwell field equations is presented in which the gravitational and electromagnetic potentials are completely determined by a harmonic function only. The motion of test particles is investigated in the background of a space-time characterized by this class of solutions. We focus on the study of circular stable and unstable orbits obtained by taking account particular harmonic functions defining the gravitational potential. We show that is possible to have repulsive force generated by the charge distribution of the source. As the space-time here considered is singularity free we conclude that this phenomena is not exclusive to the case of naked singularities. Additionally, we obtain an expression for the perihelion advance of the test particles in a general magnetized conformastatic space-time.

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Passivity-Based Control for Hydro-Turbine Governing Systems

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Abstract

In this paper an interconnection and damping assignment passivity-based control (IDA-PBC) applied to the hydro-turbine governing systems (HTGS) is proposed to regulate the relative deviation of turbine speed in single machine infinite bus system. The passivity-based control (PBC) theory is selected because in the open-loop the HTGS has a port-Hamiltonian (pH) structure. The PBC theory takes advantage of the pH structure of the open-loop dynamical system to design a general control law, which preserves the passive structure in closed-loop via interconnection and damping reassignment. Additionally, the PBC theory guarantees globally asymptotically stability in the sense of Lyapunov for the close-loop dynamical system. Time-domain simulations demonstrate the robustness and proper performance of the proposed methodology applied to the HTGS under different operative conditions.

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