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LA INVESTIGACIÓN APLICADA A LAS **CIENCIAS DE LA INGENIERÍA**



Luz Karime Ahumada Torres
Yesid Tarriba Lezama
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Editores.



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**LA INVESTIGACIÓN APLICADA A LAS
CIENCIAS DE LA INGENIERÍA**



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Con el lema "DESAFÍOS EN INGENIERÍA: INVESTIGACIÓN APLICADA", Expotecnología 2019 enmarca su magno evento creando espacios para generar integración de diversas áreas de ingeniería en torno a investigación aplicada. Expotecnología es un evento académico con diecisiete años de trayectoria, que surge desde la Facultad de Ciencias de la Ingeniería de la Fundación Universitaria Antonio de Arévalo, con la idea de brindar un espacio diferente, donde los estudiantes y profesionales de las áreas de la ingeniería puedan interactuar con la comunidad académica afín.



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LA INVESTIGACIÓN APLICADA A LAS CIENCIAS DE LA INGENIERÍA



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La Investigación Aplicada a las Ciencias de la Ingeniería

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UNA SOLUCIÓN PARA IOTB BASADA EN NLEACH Y DBFT

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RESUMEN

La propuesta del diseño de una Arquitectura IoTB basado en el protocolo NLEACH y el protocolo de consenso DBFT, permite crear una arquitectura de confianza distribuida base para establecer una de red de transmisión de datos en IoT de forma jerárquica y segura, donde se establece una coordinada comunicación entre los dispositivos finales, esto gracias al establecimiento de subgrupos en la WSN en base a validadores específicos seleccionados con capacidad de almacenamiento y procesamiento para establecer en sí el consenso final de los datos, el diseño ofrece una arquitectura que fácilmente se integra a soluciones ML, donde se utiliza el consenso para verificar los resultados de un algoritmo de aprendizaje de máquinas y entrenarlo para afinar los resultados, bajo la supervisión de muchos sensores organizados jerárquicamente, además gracias al protocolo NLEACH se reduce el consumo de energía de los nodos, equilibrar la carga, reducir el retardo de transmisión, aumentar la tolerancia a fallos y la robustez de la red, además de mejorar la seguridad de la información y garantizar la estabilidad de la red.

Palabras Claves: IoTB (Internet of Thing Blockchain), WSN (Wireless sensor networks), DBFT (Delegated Byzantine Fault Tolerance), NLEACH (Low-energy adaptive clustering hierarchy), Blockchain.

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WEB APPLICATION FOR INVENTORY MANAGEMENT IN A SME (PYME)

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ABSTRACT

According to the boom in the use of technology and the internet in the different fields of development, companies are implementing in their processes, a technological infrastructure and in this way the treatment of information will allow a better communication in real-time. The more common use of technology has made a significant contribution to the development, monitoring and management of organizational processes in a company improving response times and performance. Allowing in this way that a SME (Pyme) is more competitive and sustainable in the long-term.

In a company that has as input the operative processes in the registry and update of an inventory, in front of the earlier process a good management and administration of the information must be done. One of the main factors that affect the performance of companies and the profits obtained, are based on the treatment of this important input identified as information. Therefore, it is essential for companies to have an inventory that is effectively managed allowing their control in real-time establishing priorities in the follow-up of objectives according to the goals set by the company making effective use of resources. In addition to this, it offers the option to record the sales and purchases movement in a fast and easy way.

In the implementation of a technological development the advantages are directed towards the company and each one of the clients that can be attended in record time allowing the generation of an invoice with the list of items specifying their prices as proof of payment guaranteeing security in the selling process. The development will be carried out having as an architectural pattern the model view controller and use of Framework Laravel and Vue.js developing in the PHP programming language making the application more robust and scalable.

Keywords: Web application, System, Inventory, Bill, Systematization, SME, Pyme

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PLATFORM FOR ELECTRONIC INVOICES IN A SME (PYME)

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ABSTRACT

This technological development has the purpose of guiding the construction of a management system for the automation of the processes involved in processing, processing and issuing an electronic invoice in small and medium-sized companies in the metropolitan area of the city of Bucaramanga. Of great help for these small and medium economies as they offer various tools that improve and optimize the processes necessary for the sale, purchase and inventory of products; With the development of process management systems, operational procedures can be shortened that will help optimize and effectively make decisions that allow the entities that implement them to increase their level of competitiveness and streamline processes (Maurera, 2011) [1] Errors for human resources are minimal and the most productive processes, increasing the competitiveness of small and medium enterprises that operate in any economic sector.

At the end of this project it is expected to get a functional web prototype that allows processing and issue electronic invoices with their respective digital signature, issued in any of the permitted formats and store them for later availability. The methodology proposed for this project is the "software life cycle" system, which consists of a linear cascade methodology that ensures that each stage is developed and fulfilled before moving on to the next one, thus keeping a fairly accurate control of the activities and time for its development, a deep and extensive analysis will be done, in addition, the abstraction of the main components that intervene in the electronic billing process, the project structure will be designed and the computer solution will be implemented according to the problem, once these stages have been successfully completed, local tests of different areas to the application will be carried out to correct adjustments and rectify requirements.

Keywords: Web application, System, Inventory, Invoice, Bill, Systematization, SME, Pyme

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PLATAFORMA MECATRÓNICA PARA APLICACIÓN DE HERBICIDAS

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RESUMEN

El presente documento tiene como finalidad establecer el diseño de una plataforma mecatrónica para la aplicación de herbicidas en cultivos de hortalizas de fase temprana, para automatizar el proceso, dicha necesidad ha surgido debido a los daños que provocan en el ser humano los tóxicos herbicidas. El objetivo principal es analizar los parámetros primordiales que conforma una plataforma mecatrónica, basados en las características físicas y eléctricas que presenta cada una de las etapas (electrónica, mecánica, potencia), representada en el procedimiento y método de ejecución. El resultado de la investigación se enfoca en determinar el modelo y estrategia para el desplazamiento óptimo de la plataforma móvil y el control de movimientos en terrenos que presentan condiciones complejas para su trayectoria, en particular y su aplicación para sistemas robóticos autónomos dentro del área agrícola.

Palabras Claves: Control, Herbicida, Mecatrónica, Plataforma, Sistema

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EVALUATING A NEW BINDER IN THE SELF-LEVELING MORTAR MIXTURE

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ABSTRACT

The infrastructure of a country plays an important role in economic growth, contributing as a basis for other actors such as: production, transport and access to services that meet basic population needs. In this article we study the Sika-Colombia company dedicated to the construction material supplies, specifically self-leveling mortars, in relation to an improvement of physical properties (i.e. resistance and consistency) and production costs. The impact of new binder addition in a self-leveling mortar mixture Sika Grout 212 is analyzed experimentally. This approach is justified by the need to improve the granular skeleton of the study product, recover fluidity and maintain the resistance offered to customers. The research results conclude the physical and economic advantages of new binder adding to the mortar mixture as well as optimum composition.

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EVALUATION OF TRIANGLE'S TRIPLE RESTRICTION ON CONVENTIONAL CONSTRUCTION AND MODULAR CONSTRUCTION- EXAMPLE: NEW BUILDING OF THE UNIVERSITY OF THE COAST

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ABSTRACT

This document evaluates and compares the modular construction system against the conventional construction system, analyzing it from the triple restriction triangle of the PMBOK guide (5th edition), which corresponds to the analysis of the scope, time and cost that can be achieved in the execution, which is focused directly on a real building of higher education, as a case study was used the university corporation of the CUC coast located in the city of Barranquilla. The main purpose of the research is to demonstrate the strengths, advantages and disadvantages of each construction system and once real results are obtained they facilitate their application in professional practice for the management of the works and the execution of higher education projects, of This way, new construction processes are promoted as a contribution to the development of architecture and innovation in Colombia

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EVALUATION OF THE COUGHING POWER OF THE OPUNTIA FICUS INDICA FOR REMOVAL OF TURBIDITY IN WATERS OF THE GUATAPURI RIVER (COLOMBIAN CARIBBEAN)

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ABSTRACT

The purpose of this article is to publicize the evaluation of the effectiveness of *Opuntia ficus indica* as a coagulant during the treatment of raw water from the middle basin of the Guatapuri River, in the Department of Cesar, Colombia. Tuna coagulant is purely organic; it has been shown by phytochemical studies performed on *Opuntia ficus indica* the presence of some minerals among some others; contains glyicides or carbohydrates. The evaluation was carried out using the jug test equipment, which operated by varying the revolutions per minute (20, 30 and 40), keeping the mixture fast at 125 rpm and settling for 30 minutes. The samples were physically characterized (Turbidity, Alkalinity, pH and total suspended solids) taking into account the methods specified for parameter in the Standard Methods. With samples of 345.9 NTU and 2799.1 NTU at optimal doses of 658.75 mg/L and 1976.3 mg/L respectively, removals up to 97% and 99.5% were observed in the same order. It was shown that the variation of the slow mixture only influenced with the sample of 2799.1 NTU, being the most effective treatment at 30 RPM.

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MODELO DE NEGOCIO PARA UNA UNIVERSIDAD VIRTUAL EN COLOMBIA

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RESUMEN

El presente capítulo define el modelo de negocio para una Universidad Virtual en Colombia, teniendo en cuenta el análisis de situación de entorno general, específico, y el modelo Canvas. De acuerdo con el Sistema Nacional de Educación Superior, actualmente, en Colombia hay 301 Instituciones de Educación Superior IES, de las cuales el 41% se encuentran establecidas en Bogotá. Estas instituciones tienen su domicilio en 81 municipios de los 1.122 municipios del país, es decir, en solo el 7% del país, y solo 40 IES ofrecen programas virtuales o a distancia. El 91% de programas académicos se ofrecen en metodología presencial, 4% distancia, y el 5% virtual. La tasa de cobertura actual de educación superior es del 50%. Estas cifras evidencian una oferta insuficiente y concentrada en la capital del país, lo cual genera problemas de acceso para quienes no residen en entornos urbanos, o para quienes por razones de tipo personal no pueden tomar la oferta presencial. Para definir el modelo de negocio, inicialmente, se realizó un análisis detallado del entorno general y específico. Posteriormente, se estructuró el modelo de negocio, y la ruta estratégica para su puesta en marcha. Los resultados muestran que, las condiciones del entorno son favorables para este tipo de iniciativas. Como conclusión, se evidencia que entre los factores claves de éxito de una universidad virtual se encuentran: disponibilidad de la plataforma tecnológica, pertinencia de los programas, y la figura de tutores – adicionales al profesor- que acompañen al estudiante en su proceso.

Palabras Claves: Análisis de entorno, Canvas, Educación virtual, Instituciones de Educación superior, Modelo de negocio.

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OBTAINING A SUGAR SYRUP FROM THE USE OF THE EXTRACT OF THE GUÁCIMO FRUIT (GUAZUMA ULMIFOLIA LAM)

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ABSTRACT

The main objective of this work was to elaborate a sugary syrup from the use of Guácimo fruit extract (Guazuma Ulmifolia Lam) using the leaching method (solid - liquid), which can be used as a partial or total substitute for sugar. The experimental design that was applied for the extraction process was a factorial design 2³; the data obtained were evaluated with the software Statgraphics. Once the extracts were obtained, physico-chemical tests were carried out and reductive sugars and dextrose equivalent were determined in each one. To obtain the syrup, the four extracts having the highest% ED were concentrated at constant temperature and time (50 ° C and 4 hours); The determination of the presence of reducing sugars was done using the techniques of colorimetric analysis (miller's method) and chromatography (HPLC). The products that were obtained during the process were extreme conversion syrups with a range of dextrose equivalents of 90.13% - 98.27%. The syrup that obtained the highest percentage of equivalent dextrose (J3) was subjected to a sensory hedonic test, which consisted of 3 samples of sweetened coffee at different concentrations of sweet sugar syrup and sugar (sucrose), where M1 contained 80% sugar syrup of guácimo and 20% of table sugar. M2 contained 50% guácimo sugar syrup and 50% table sugar. M3 contained 100% sugar guacimo syrup and 0% table sugar. The results showed that the mixture that obtained the highest organoleptic acceptance was M2, followed by M3, which states that the syrup can substitute partially the common sugar. The above data allow the guácimo fruit to be taken into account as an alternative raw material for the production of sugar syrups and other products aimed at human consumption.

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BAYESIAN ESTIMATION OF NON-STRUCTURAL PARAMETERS IN AN AUTOREGRESSIVE MODEL OF TAR THRESHOLDS

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ABSTRACT

Bayesian estimates were compared with informative and non-informative a priori distributions in the non-structural parameters of a TAR model. Initially, ART models were simulated with two regimes, later the Gibbs sampler was used to generate a posteriori samples of the parameters and obtain the point estimates, intervals of credibility and intervals of maximum probability density, both for a prioris informative and non-informative and finally, the distributions are compared a posteriori using the Bayes Factor. The results show that the Bayesian estimates are very close to the real values of the parameters and that the credibility intervals contain these values, although the credibility intervals are wider with a prioris not informative, the Bayes factor indicates that there is no important difference between a posteriori distribution.

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MOBILE APPLICATION DEVELOPMENT TO PROMOTE THE SUSTAINABLE TRANSPORT OF AGRICULTURAL PRODUCTS

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ABSTRACT

Mobile applications today are present in most situations of daily life and in the productive sectors of the global economy. However, when talking about the rural areas of developing countries, the reality is different due to the difficulties for access, use and quality of the use of information and telecommunications technologies; the same problem of technological coverage occurs with the transport of agricultural products. This article presents a mobile application as a result of the research process, which makes the shared use of cargo vehicles easier and allows the integration of small and medium farmers with markets and transport companies. In this way, the costs of transport processes are reduced and agriculture becomes a more productive and competent activity with a view to fulfilling the sustainable development goals.

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IDENTIFICATION OF CRITICAL VARIABLES IN CONVENTIONAL TRANSFORMERS IN DISTRIBUTION NETWORKS

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ABSTRACT

Transformers are essential equipment to the operation of electrical power systems, a failure causes the lack of electricity supply to end-users, affecting the operating indicators of companies in the distribution sector. The investigation presents an identification of the faults in transformers through a fishbone diagram, an evaluation of the variables that cause the identified failure using the cross-impact matrix method and a proposal to improve the performance. The results will enable a plan to be developed for taking action with monitoring plans to avoid faults that could put the electrical asset at risk and achieve a better performance of the distribution network.

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DRIVERS OF BIOMASS POWER GENERATION TECHNOLOGIES: ADOPTION IN COLOMBIA

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ABSTRACT

The share of non-conventional renewable energies in Colombia represents less than 4% of electricity generation; the government aims to increase the net installed electricity generation capacity to over 10% by 2028. A structural analysis was carried out for decision-making: international experiences was used to identify Social, Environmental, Technical and Economic indicators and with the MICMAC method, the key variables were identified to define improvement strategies. This research determined the driver elements that will allow Colombia to effectively include biomass as an electrical energy source.

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COMPARISON OF THE KRAGTEN, GUM AND RELATIVE METHODS TO EVALUATE THE MEASUREMENT UNCERTAINTY IN BIMETALLIC THERMOMETERS

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ABSTRACT

The main goal of this paper is to compare the methods of Kragten, UM (Guide for the expression of measurement uncertainty) and Relative uncertainty in order to evaluate the uncertainty of measurement in bimetallic thermometers. The main motivation for the development of the work is based on a need detected at the industry to increase the metrological reliability of thermometers for temperature control in the most diverse measurement processes. It is known that, the results of the expanded uncertainty depend on the applied method. So, the method applied for estimating the measurement uncertainty impacts significantly on its final result. Thus, apply and evaluate different methods is a strategy in order to obtain minor uncertainties of measurement that, unquestionably, producer economic advantages for the control of industrial processes. The applied methodology is based on the concepts enshrined in the classical literature about the GUM, Kragten and Relative methods. The consolidated results confirmed that, for temperature measurement applications, the GUM method is more appropriate for estimating the measurement uncertainty. The value obtained was equal to 1.22 °C throughout the calibration range of the instrument, with the exception of the experimental point whose reference temperature was 50 °C. At this experimental point an uncertainty of 1.21 °C was obtained. As a conclusion, this work showed that an increase in metrological reliability for the measurement of temperature, fundamental magnitude in industrial processes, can be obtained by the evaluation of different methods for estimating the measurement uncertainty.

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KINETIC STUDY OF CYANIDE DEGRADATION FROM GOLD MINING WASTEWATER USING PHOTOCATALYSIS

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ABSTRACT

Highly toxic cyanides are among the most persistent chemical compounds in effluents, these chemicals are used in several industrial sectors and particularly in mining industry for the extraction of gold. Cyanides frequently appear at low levels in water, deteriorating its quality. In this paper a degradation of 55.76% and 62.99% was obtained using TiO₂ catalyst and TiO₂ doped with Cu heteropololybdate respectively in 360 min of reaction, applying photodegradation with a 125 watt mercury lamp source. Most of the trials showed that the degraded compound kinetics may be adjusted to a pseudo first order model.

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DEGRADATION OF CYANIDE FROM GOLD MINING WASTEWATER USING PHOTOCATALYSIS

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ABSTRACT

In recent years, water quality issues related with hazardous wastewater and toxic substances have attracted worldwide attention. Cyanide is a major toxin in wastewater resulting from a diversity of industries, including gold mining. Cyanide has adverse health effects on people as well as other living organisms. The toxic effects of cyanide are so important to cause nerve damage and thyroid glands malfunctioning. In this paper, the degradation of cyanide in waters resulting from gold mining activity was carried out in a batch system with two catalysts TiO₂ Degussa P-25 and TiO₂ doped with copper heteropolyimolybdate, that was synthesized in laboratory and characterized by FTIR and XRD. Assays showed a degradation of 98.55% with a concentration of 0.3 g/L of TiO₂ and 97.17% with TiO₂ doped with 1% of Cu heteropolyimolybdate (1 g/L) in 50 min of reaction. A real mining sample showed a cyanide degradation of 55.76% with TiO₂ in 240 min of reaction. All the assays were made applying photodegradation using a 125-Watt mercury lamp as source. These results are encouraging to use this technology for the removal of cyanide coming from highly contaminated aqueous effluents.

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RISK ASSESSMENT OF PCP LIFT SYSTEM USING A FISHBONE DIAGRAM AND MICMAC METHOD

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ABSTRACT

Hydrocarbons demand by industrialized and developed nations and the oil prices conditions last few years; many companies have turned again to fields that were not previously considered attractive to produce, to identify them as an alternative to meet that demand. This research shows the identification of a condition, which should be taken into account to produce a mature field by progressive cavity pumping (PCP) artificial lift system, an evaluation with the MICMAC method and the identification of the key variables to achieve the development in this practice. The results make possible to identify highest influence elements, which can guide intervention strategies and form the basis to formulate guidelines and policies for the PCP implementation. The results allow us to conclude that pressures and mechanical designs in field wells should be the guidelines for optimum production, the market rate improvement, and the reservoir productive life.

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PROSPECTIVE TOWARDS IMPLEMENTATION OF ELECTRIC VEHICLES IN COLOMBIA

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ABSTRACT

The effects of climate change have led to reduces fossil fuel in vehicle, developing new technologies such as the electric vehicles. The research presents an identification of barriers and inhibitors according to international experiences, an evaluation with the MICMAC method and the identification of key factors to achieve development of electric vehicles in Colombia. The results allow to identify the elements of high influence, which may guide intervention strategies and be the basis for the formulation of guidelines and policies. The results conclude that the business models for the purchase and sale of energy are the catalyst for the encouraging of the stakeholders, the improvement of the distribution network and the management of the electricity market.

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OFFSHORE OIL EXPLOITATION IN THE CARIBBEAN SEA: CHALLENGES FOR COLOMBIA

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ABSTRACT

Colombia began an expansion plan for oil exploration in the Caribbean Sea, this industry is recognized for the high impact it can generate, being necessary to identify mechanisms to improve management. This research presents a review of the experiences in the offshore oil industry, describes the case of oil exploration in the Arctic, a fragile ecosystem; methodologies and indicators used to strengthen the industry in order to achieve sustainability are identified. The results allow to conclude that it is necessary to strengthen the development plan from the institutional and political frameworks using a Strategic Environmental Assessment, also they indicate how this can improve the instruments and achieve improvement in the social, economic and environmental dimensions.

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RETOS DE LA GESTIÓN DEL TALENTO HUMANO EN LA INDUSTRIA 4.0

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RESUMEN

Los grandes cambios de transformación de los ambientes industriales a nivel mundial traídos por la cuarta revolución industrial, también denominada Industria 4.0, han llevado consigo la necesidad de un manejo estratégico de las personas. El objetivo de este capítulo es abordar en esta investigación el análisis de los retos que tienen las nuevas empresas para visualizar la sintonía entre el crecimiento tecnológico y el talento humano. Para los fines de la indagación se llevó a cabo una metodología sistémica que dio las pautas para analizar el contexto real de trabajo sobre el tema en las bases de datos Web of Science y Scopus, al igual que una vigilancia tecnológica mediante el software de minería de datos VantagePoint. Se pudo evidenciar que con la llegada de esta nueva revolución industrial llegarán cambios drásticos en los perfiles de los trabajos, las competencias del personal y la selección del mismo que repercuten directamente en la creación de nuevas habilidades para adaptar las nuevas tecnologías, también se invita como conclusión general a analizar la gestión de personas y a discutir las diferentes problemáticas para el proceso de adaptación a nivel mundial para un mejor rendimiento. Esta tendencia involucra la formación de nuevo talento humano al sector industrial y de servicios como lo es el gobierno y los sistemas educativos.

Palabras Claves: Industria 4.0, Gestión del talento humano, Recurso Humano, Talento Humano, Operador 4.0, Fábricas inteligentes, Cuarta revolución industrial.

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**COMMUNICATIONS IN FLEXIBLE SUPERVISOR FOR LABORATORY RESEARCH IN
RENEWABLE ENERGY**

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ABSTRACT

In laboratories new systems are created where researchers hope to obtain improved functions at a reasonable cost. In them, specialists need efficient tools that offer better performance and flexible features. This paper designs and implements a SCADA system for GERA laboratory (Scientific Group for Applied Renewable Energy at the University of Oriente) adjusted to the inherent characteristics of flexibility and functionality required in research centers. All these features are supported in an efficient communication system with the implementation of various protocols and novel solutions for this type of systems for monitoring and control. It verifies and validates the system for formal methods.

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DESIGN OF A FUZZY CONTROLLER FOR A HYBRID GENERATION SYSTEM

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ABSTRACT

This paper presents the design of a control system for the automatic connection/disconnection and distribution of load, between an asynchronous alternator and a generator, in a hydroelectric central that works in isolated mode. The design of a control algorithm based on fuzzy logic is exposed, as this is a flexible method to be used in different installations with a variety of technology. The controller is supported on the Arduino Mega 2560 platform, in order to develop a low-cost system with its own technology, it is tested by computer simulation using the professional software Proteus v7.7, which guarantees that once validated the correct operation of the controller can be migrated to another system, say for example a PLC. The results obtained are shown and the simulations performed to the different blocks of the system are explained.

Keywords:

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**A PROPOSAL FOR UPDATING THE RESPONSE SPECTRUM OF SAN JOSE DE CUCUTA,
COLOMBIA**

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ABSTRACT

An analysis of seismic signals captured in three stations of the network of accelerographs of the Colombian Geological Service (SGC, by its acronym in Spanish) was developed for the city of San Jose de Cucuta, Colombia. Earthquake Equivalent, Response Analysis (EERA) and DEGTRA4 software were used for analysis, processing and calculation of signal response spectra during the characterization and propagation modelling of the signal by profiles. For the accelerograms family, a normalization factor computed with respect to the Peak Ground Acceleration (PGA) was obtained by superposition against the typical design spectrum of the Colombian earthquake resistant code (NSR10). It was found that there is a band of frequencies above the maximum acceleration zone of the design spectrum of the current standard. This suggests a revision of the seismic threat of the city of Cucuta and the urgent need to develop the seismic microzoning, which would allow a substantial reduction of the seismic risk.

Keywords: Response Spectrum, simple oscillator, Peak Ground Acceleration (PGA).

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**POTENTIAL ENERGY SAVINGS IN COMPRESSED AIR SYSTEMS IN INDUSTRIALIZED CITIES.
A CASE STUDY IN BARRANQUILLA AND CARTAGENA**

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ABSTRACT

The increase of energy consumption, global warming, resource depletion and the rise of policies focused on climate change and greenhouse gas emissions reductions, have promoted to countries and industries the implementation of strategies focused on increase energy efficiency and reduce GHG emissions. Compressed Air Systems (CASs) are one of the most widespread systems used in industry. In countries such as China, USA, Australia, France and Italy, CASs accounts around 10% of the overall electricity costs. In Colombia the energy used in the industrial sector, rise the 33 % of the total energy consumption, equal to 481.429 TJ/year; the electricity consumption is a 13 % of this value, equivalent to 13,3 TWh/year. This paper determine the potentials energy saving of CASs for two industrial cities of the Colombian Caribbean Coast region, showing that there is a high energy saving potential, around 50 GWh/year and a reduction of CO₂ emissions of 10,702 tons of CO₂/year, which can be taken in consideration by the government and organizations to develop projects focused on reduce energy consumption and mitigate CO₂ emissions.

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USO DE SMARTPHONE COMO FOTOCOLORÍMETRO PARA MEDIR LA ABSORBANCIA DE SUSTANCIAS COLORIDAS

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RESUMEN

Actualmente en Colombia se comercializa una gran cantidad de bebidas alimenticias, siendo las principales en su consumo la gaseosa y jugos artificiales, estas contienen colorantes artificiales que simulan el color de las frutas las cuales pueden poseer cierto grado de alergénicos, resultado de sustancias tóxicas como el amoníaco y los sulfitos que en la mayoría de los casos desconocemos cuán nociva son para la salud, afectando mayormente a los niños, dañando el ADN y con posible riesgo de cáncer.

Para realizar el análisis de la concentración de colorante se utiliza un instrumento llamado espectrómetro de luz; este tipo de tecnología no está al alcance de muchos químicos que en sus laboratorios no cuentan con estos equipos, lo cual limita el estudio para la identificación de colorante en la bebida.

Utilizando la ley de Beer Lambert, también conocida comúnmente como la ley de Beer, permite calcular la concentración de una sustancia absorbente en una solución. En los resultados de nuestro experimento se utilizan soluciones de colorante azul de alimentos, demostrando que los datos de absorbancia versus los datos de concentración son lineales para los datos obtenidos, usando teléfonos inteligentes con cámara mediante la aplicación (color grab). Para La obtención de datos confiables es necesario tomar una sola imagen por cada muestra, con un fondo blanco para que no altere el color de las muestras, El enfoque proporciona un método fácil para realizar el análisis del colorimétrico desde el laboratorio de química para introducir los conceptos de química analítica y de procesos, entre otros conceptos, a los estudiantes en numerosos campos.

Palabras Clave: Ensayo químico, Smartphone, colorimetría, ley de beer.

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USE OF TECHNOLOGICAL TOOL FOR THE CONSOLIDATION OF MATHEMATICAL PRE-KNOWLEDGE IN HIGHER EDUCATION

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ABSTRACT

Currently, information and communication Technologies (ICT) have permeated the different educational, political, economic and sociocultural contexts, contributing to the inclusion and development of society by optimizing time, efforts and resources. On the other hand, (ICT) are considered powerful facilitators of the teaching-learning process at all training levels because they visibly improve the way of acquiring knowledge, becoming essential tools for educational transformation and innovation. Therefore, the purpose of this present study is to analyze the results of the first implementation of the PREIN - UTS virtual course developed in the web Khan- Academy tool. The sample was formed by new students who entered the first semester of the technological level in the academic period 2018-II of a higher education institution located in Bucaramanga Santander (N=801). The methodological approach was quantitative of exploratory type, with the use of descriptive statistics and SPSS software for data analysis. Among the research results it was evidenced that the PREIN course is an innovative and easily accessible strategy, that contributes to the assurance of mathematical skills of the upcoming students that will enter proximally.

Keywords:

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**METHODOLOGY TO DEFINE AN INTEGRATION PROCESS BETWEEN FRAMEWORKS SCRUM,
DJANGO REST FRAMEWORK Y VUE.JS, IMPLEMENTED FOR SOFTWARE DEVELOPMENT,
FROM QUALITY MANAGEMENT APPROACH AND AGILITY**

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ABSTRACT

At present, the industry has great challenges for the construction and maintenance of software, in terms of quality, costs and time, for this it is significant to have a methodological framework, which allows the possibility of having effective and practical methods, applying programming techniques from an agile approach, which guarantees the construction of quality code from the beginning of software development. This study analyzes the integration between frameworks SCRUM [1], Django REST framework [2] and Vue.js [3], which are commonly implemented in isolation for the execution of software development projects, and components are also incorporated of the IEEE 830 standard defined for the specification of software requirements [4], and of the ISO 25000 standard for software quality assessment [5]. Likewise, the characteristics of each study framework within the software architecture are analyzed, establishing of traceability between them and obtaining as a result a methodology for the definition of a process map; where each framework is integrated and it is described the procedure for structuring the planning, development and delivery phases. Thus providing a guide for the application of programming techniques from the concept of agility and quality management, from the process of integration of the frameworks analyzed in this study.

Keywords:

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TELESALUD: MARCO LEGAL PARA EL DESARROLLO TECNOLÓGICO EN COLOMBIA

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RESUMEN

El avance de las tecnologías en salud, permiten a los profesionales en las ciencias de la ingeniería poder incursionar en diferentes proyectos que conllevan a desarrollos e innovaciones tecnológicas, sin embargo, estos profesionales muchas veces desconocen las normas que regulan el desarrollo e implementación de nuevas tecnologías en el campo de la salud. Por esta razón el presente capítulo tiene como objeto describir el marco legal en Telesalud en Colombia, exponiendo las diferentes normas expedidas por los órganos del Gobierno Colombiano. Es una investigación descriptiva, basada en una revisión bibliográfica de los artículos de la constitución política del 1991, leyes, decretos, resoluciones y sentencias que ilustran los temas de salud en Colombia. Como conclusión se resalta la labor del Gobierno Colombiano por velar el cumplimiento de derechos fundamentales, como lo son la vida, la salud y seguridad social, incentivando y regulando nuevas estrategias tecnológicas con el fin de poder garantizar a todos los colombianos los servicios de salud.

Palabras Clave: Telesalud, Telemedicina, Salud, Tecnología, Normas.

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Artículo Completo: xxxxxxxx

GROWTH OPTIMIZATION OF CHLORELLA VULGARIS IN MIXOTROPHIC CULTURE ENRICHED WITH NUTRIENTS USING EXPERIMENTAL DESIGN

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ABSTRACT

In this research, statistical optimization designs were applied to evaluate the growth of the *Chlorella vulgaris* in mixotrophic cultures enriched with nitrogen and phosphorus. The influence of each factor was evaluated at three levels, so a multifactorial experimental design was created 32. The results obtained showed that microalgae growth improves 32% by adding 50 mg of nitrogen and 25 mg of Nitrogen to the culture. This project demonstrates the relevance of the design of experiments for the optimization of algal biomass production in order to obtain bioproducts.

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UNA SOLUCIÓN PARA IOTB BASADA EN NLEACH Y DBFT

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RESUMEN

La propuesta del diseño de una Arquitectura IoTB basado en el protocolo NLEACH y el protocolo de consenso DBFT, permite crear una arquitectura de confianza distribuida base para establecer una de red de transmisión de datos en IoT de forma jerárquica y segura, donde se establece una coordinada comunicación entre los dispositivos finales, esto gracias al establecimiento de subgrupos en la WSN en base a validadores específicos seleccionados con capacidad de almacenamiento y procesamiento para establecer en sí el consenso final de los datos, el diseño ofrece una arquitectura que fácilmente se integra a soluciones ML, donde se utiliza el consenso para verificar los resultados de un algoritmo de aprendizaje de máquinas y entrenarlo para afinar los resultados, bajo la supervisión de muchos sensores organizados jerárquicamente, además gracias al protocolo NLEACH se reduce el consumo de energía de los nodos, equilibrar la carga, reducir el retardo de transmisión, aumentar la tolerancia a fallos y la robustez de la red, además de mejorar la seguridad de la información y garantizar la estabilidad de la red.

Palabras Claves: IoTB (Internet of Thing Blockchain), WSN (Wireless sensor networks), DBFT (Delegated Byzantine Fault Tolerance), NLEACH (Low-energy adaptive clustering hierarchy), Blockchain.

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Artículo Completo: xxxxxxxx

WEB APPLICATION FOR INVENTORY MANAGEMENT IN A SME (PYME)

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ABSTRACT

According to the boom in the use of technology and the internet in the different fields of development, companies are implementing in their processes, a technological infrastructure and in this way the treatment of information will allow a better communication in real-time. The more common use of technology has made a significant contribution to the development, monitoring and management of organizational processes in a company improving response times and performance. Allowing in this way that a SME(Pyme) is more competitive and sustainable in the long-term.

In a company that has as input the operative processes in the registry and update of an inventory, in front of the earlier process a good management and administration of the information must be done. One of the main factors that affect the performance of companies and the profits obtained, are based on the treatment of this important input identified as information. Therefore, it is essential for companies to have an inventory that is effectively managed allowing their control in real-time establishing priorities in the follow-up of objectives according to the goals set by the company making effective use of resources. In addition to this, it offers the option to record the sales and purchases movement in a fast and easy way.

In the implementation of a technological development the advantages are directed towards the company and each one of the clients that can be attended in record time allowing the generation of an invoice with the list of items specifying their prices as proof of payment guaranteeing security in the selling process. The development will be carried out having as an architectural pattern the model view controller and use of Framework Laravel and Vue.js developing in the PHP programming language making the application more robust and scalable.

Keywords: Web application, System, Inventory, Bill, Systematization, SME, Pyme

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PLATFORM FOR ELECTRONIC INVOICES IN A SME (PYME)

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ABSTRACT

This technological development has the purpose of guiding the construction of a management system for the automation of the processes involved in processing, processing and issuing an electronic invoice in small and medium-sized companies in the metropolitan area of the city of Bucaramanga. Of great help for these small and medium economies as they offer various tools that improve and optimize the processes necessary for the sale, purchase and inventory of products; With the development of process management systems, operational procedures can be shortened that will help optimize and effectively make decisions that allow the entities that implement them to increase their level of competitiveness and streamline processes (Maurera, 2011) [1] Errors for human resources are minimal and the most productive processes, increasing the competitiveness of small and medium enterprises that operate in any economic sector.

At the end of this project it is expected to get a functional web prototype that allows processing and issue electronic invoices with their respective digital signature, issued in any of the permitted formats and store them for later availability. The methodology proposed for this project is the "software life cycle" system, which consists of a linear cascade methodology that ensures that each stage is developed and fulfilled before moving on to the next one, thus keeping a fairly accurate control of the activities and time for its development, a deep and extensive analysis will be done, in addition, the abstraction of the main components that intervene in the electronic billing process, the project structure will be designed and the computer solution will be implemented according to the problem, once these stages have been successfully completed, local tests of different areas to the application will be carried out to correct adjustments and rectify requirements.

Keywords: Web application, System, Inventory, Invoice, Bill, Systematization, SME, Pyme

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PLATAFORMA MECATRÓNICA PARA APLICACIÓN DE HERBICIDAS

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RESUMEN

El presente documento tiene como finalidad establecer el diseño de una plataforma mecatrónica para la aplicación de herbicidas en cultivos de hortalizas de fase temprana, para automatizar el proceso, dicha necesidad ha surgido debido a los daños que provocan en el ser humano los tóxicos herbicidas. El objetivo principal es analizar los parámetros primordiales que conforma una plataforma mecatrónica, basados en las características físicas y eléctricas que presenta cada una de las etapas (electrónica, mecánica, potencia), representada en el procedimiento y método de ejecución. El resultado de la investigación se enfoca en determinar el modelo y estrategia para el desplazamiento óptimo de la plataforma móvil y el control de movimientos en terrenos que presentan condiciones complejas para su trayectoria, en particular y su aplicación para sistemas robóticos autónomos dentro del área agrícola.

Palabras Claves: Control, Herbicida, Mecatrónica, Plataforma, Sistema

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EVALUATING A NEW BINDER IN THE SELF-LEVELING MORTAR MIXTURE

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ABSTRACT

The infrastructure of a country plays an important role in economic growth, contributing as a basis for other actors such as: production, transport and access to services that meet basic population needs. In this article we study the Sika-Colombia company dedicated to the construction material supplies, specifically self-leveling mortars, in relation to an improvement of physical properties (i.e. resistance and consistency) and production costs. The impact of new binder addition in a self-leveling mortar mixture Sika Grout 212 is analyzed experimentally. This approach is justified by the need to improve the granular skeleton of the study product, recover fluidity and maintain the resistance offered to customers. The research results conclude the physical and economic advantages of new binder adding to the mortar mixture as well as optimum composition.

Keywords:

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EVALUATION OF TRIANGLE'S TRIPLE RESTRICTION ON CONVENTIONAL CONSTRUCTION AND MODULAR CONSTRUCTION- EXAMPLE: NEW BUILDING OF THE UNIVERSITY OF THE COAST

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ABSTRACT

This document evaluates and compares the modular construction system against the conventional construction system, analyzing it from the triple restriction triangle of the PMBOK guide (5th edition), which corresponds to the analysis of the scope, time and cost that can be achieved in the execution, which is focused directly on a real building of higher education, as a case study was used the university corporation of the CUC coast located in the city of Barranquilla. The main purpose of the research is to demonstrate the strengths, advantages and disadvantages of each construction system and once real results are obtained they facilitate their application in professional practice for the management of the works and the execution of higher education projects, of This way, new construction processes are promoted as a contribution to the development of architecture and innovation in Colombia.

Keywords:

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EVALUATION OF THE COAGULATING POWER OF THE OPUNTIA FICUS INDICA FOR REMOVAL OF TURBIDITY IN WATERS OF THE GUATAPURI RIVER (COLOMBIAN CARIBBEAN)

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ABSTRACT

The purpose of this article is to publicize the evaluation of the effectiveness of *Opuntia ficus indica* as a coagulant during the treatment of raw water from the middle basin of the Guatapuri River, in the Department of Cesar, Colombia. Tuna coagulant is purely organic; it has been shown by phytochemical studies performed on *Opuntia ficus indica* the presence of some minerals among some others; contains glycosides or carbohydrates. The evaluation was carried out using the jug test equipment, which operated by varying the revolutions per minute (20, 30 and 40), keeping the mixture fast at 125 rpm and settling for 30 minutes. The samples were physically characterized (Turbidity, Alkalinity, pH and total suspended solids) taking into account the methods specified for parameter in the Standard Methods. With samples of 345.9 NTU and 2799.1 NTU at optimal doses of 658.75 mg/L and 1976.3 mg/L respectively, removals up to 97% and 99.5% were observed in the same order. It was shown that the variation of the slow mixture only influenced with the sample of 2799.1 NTU, being the most effective treatment at 30 RPM.

Keywords:

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MODELO DE NEGOCIO PARA UNA UNIVERSIDAD VIRTUAL EN COLOMBIA

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RESUMEN

El presente capítulo define el modelo de negocio para una Universidad Virtual en Colombia, teniendo en cuenta el análisis de situación de entorno general, específico, y el modelo Canvas. De acuerdo con el Sistema Nacional de Educación Superior, actualmente, en Colombia hay 301 Instituciones de Educación Superior IES, de las cuales el 41% se encuentran establecidas en Bogotá. Estas instituciones tienen su domicilio en 81 municipios de los 1.122 municipios del país, es decir, en solo el 7% del país, y solo 40 IES ofrecen programas virtuales o a distancia. El 91% de programas académicos se ofrecen en metodología presencial, 4% distancia, y el 5% virtual. La tasa de cobertura actual de educación superior es del 50%. Estas cifras evidencian una oferta insuficiente y concentrada en la capital del país, lo cual genera problemas de acceso para quienes no residen en entornos urbanos, o para quienes por razones de tipo personal no pueden tomar la oferta presencial. Para definir el modelo de negocio, inicialmente, se realizó un análisis detallado del entorno general y específico. Posteriormente, se estructuró el modelo de negocio, y la ruta estratégica para su puesta en marcha. Los resultados muestran que, las condiciones del entorno son favorables para este tipo de iniciativas. Como conclusión, se evidencia que entre los factores claves de éxito de una universidad virtual se encuentran: disponibilidad de la plataforma tecnológica, pertinencia de los programas, y la figura de tutores – adicionales al profesor- que acompañen al estudiante en su proceso.

Palabras Claves: Análisis de entorno, Canvas, Educación virtual, Instituciones de Educación superior, Modelo de negocio.

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OBTAINING A SUGAR SYRUP FROM THE USE OF THE EXTRACT OF THE GUÁCIMO FRUIT (GUAZUMA ULMIFOLIA LAM)

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ABSTRACT

The main objective of this work was to elaborate a sugary syrup from the use of Guácimo fruit extract (Guazuma Ulmifolia Lam) using the leaching method (solid - liquid), which can be used as a partial or total substitute for sugar. The experimental design that was applied for the extraction process was a factorial design 2³; the data obtained were evaluated with the software Statgraphics. Once the extracts were obtained, physico-chemical tests were carried out and reductive sugars and dextrose equivalent were determined in each one. To obtain the syrup, the four extracts having the highest% ED were concentrated at constant temperature and time (50 ° C and 4 hours); The determination of the presence of reducing sugars was done using the techniques of colorimetric analysis (miller's method) and chromatography (HPLC). The products that were obtained during the process were extreme conversion syrups with a range of dextrose equivalents of 90.13% - 98.27%. The syrup that obtained the highest percentage of equivalent dextrose (J3) was subjected to a sensory hedonic test, which consisted of 3 samples of sweetened coffee at different concentrations of sweet sugar syrup and sugar (sucrose), where M1 contained 80% sugar syrup of guácimo and 20% of table sugar. M2 contained 50% guácimo sugar syrup and 50% table sugar. M3 contained 100% sugar guacimo syrup and 0% table sugar. The results showed that the mixture that obtained the highest organoleptic acceptance was M2, followed by M3, which states that the syrup can substitute partially the common sugar. The above data allow the guácimo fruit to be taken into account as an alternative raw material for the production of sugar syrups and other products aimed at human consumption.

Keywords:

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BAYESIAN ESTIMATION OF NON-STRUCTURAL PARAMETERS IN AN AUTOREGRESSIVE MODEL OF TAR THRESHOLDS

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ABSTRACT

Bayesian estimates were compared with informative and noninformative a priori distributions in the non-structural parameters of a TAR model. Initially, ART models were simulated with two regimes, later the Gibbs sampler was used to generate a posteriori samples of the parameters and obtain the point estimates, intervals of credibility and intervals of maximum probability density, both for a prioris informative and non-informative and finally, the distributions are compared a posteriori using the Bayes Factor. The results show that the Bayesian estimates are very close to the real values of the parameters and that the credibility intervals contain these values, although the credibility intervals are wider with a prioris not informative, the Bayes factor indicates that there is no important difference between a posteriori distribution.

Keywords:

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**MOBILE APPLICATION DEVELOPMENT TO PROMOTE THE SUSTAINABLE TRANSPORT OF
AGRICULTURAL PRODUCTS**

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ABSTRACT

Mobile applications today are present in most situations of daily life and in the productive sectors of the global economy. However, when talking about the rural areas of developing countries, the reality is different due to the difficulties for access, use and quality of the use of information and telecommunications technologies; the same problem of technological coverage occurs with the transport of agricultural products. This article presents a mobile application as a result of the research process, which makes the shared use of cargo vehicles easier and allows the integration of small and medium farmers with markets and transport companies. In this way, the costs of transport processes are reduced and agriculture becomes a more productive and competent activity with a view to fulfilling the sustainable development goals.

Keywords:

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IDENTIFICATION OF CRITICAL VARIABLES IN CONVENTIONAL TRANSFORMERS IN DISTRIBUTION NETWORKS

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ABSTRACT

Transformers are essential equipment to the operation of electrical power systems, a failure causes the lack of electricity supply to end-users, affecting the operating indicators of companies in the distribution sector. The investigation presents an identification of the faults in transformers through a fishbone diagram, an evaluation of the variables that cause the identified failure using the cross-impact matrix method and a proposal to improve the performance. The results will enable a plan to be developed for taking action with monitoring plans to avoid faults that could put the electrical asset at risk and achieve a better performance of the distribution network.

Keywords:

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DRIVERS OF BIOMASS POWER GENERATION TECHNOLOGIES: ADOPTION IN COLOMBIA

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ABSTRACT

The share of non-conventional renewable energies in Colombia represents less than 4% of electricity generation; the government aims to increase the net installed electricity generation capacity to over 10% by 2028. A structural analysis was carried out for decision-making: international experiences was used to identify Social, Environmental, Technical and Economic indicators and with the MICMAC method, the key variables were identified to define improvement strategies. This research determined the driver elements that will allow Colombia to effectively include biomass as an electrical energy source.

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COMPARISON OF THE KRAGTEN, GUM AND RELATIVE METHODS TO EVALUATE THE MEASUREMENT UNCERTAINTY IN BIMETALLIC THERMOMETERS

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ABSTRACT

The main goal of this paper is to compare the methods of Kragten, UM (Guide for the expression of measurement uncertainty) and Relative uncertainty in order to evaluate the uncertainty of measurement in bimetallic thermometers. The main motivation for the development of the work is based on a need detected at the industry to increase the metrological reliability of thermometers for temperature control in the most diverse measurement processes. It is known that, the results of the expanded uncertainty depend on the applied method. So, the method applied for estimating the measurement uncertainty impacts significantly on its final result. Thus, apply and evaluate different methods is a strategy in order to obtain minor uncertainties of measurement that, unquestionably, producer economic advantages for the control of industrial processes. The applied methodology is based on the concepts enshrined in the classical literature about the GUM, Kragten and Relative methods. The consolidated results confirmed that, for temperature measurement applications, the GUM method is more appropriate for estimating the measurement uncertainty. The value obtained was equal to 1.22 °C throughout the calibration range of the instrument, with the exception of the experimental point whose reference temperature was 50 °C. At this experimental point an uncertainty of 1.21 °C was obtained. As a conclusion, this work showed that an increase in metrological reliability for the measurement of temperature, fundamental magnitude in industrial processes, can be obtained by the evaluation of different methods for estimating the measurement uncertainty.

Keywords:

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KINETIC STUDY OF CYANIDE DEGRADATION FROM GOLD MINING WASTEWATER USING PHOTOCATALYSIS

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ABSTRACT

Highly toxic cyanides are among the most persistent chemical compounds in effluents, these chemicals are used in several industrial sectors and particularly in mining industry for the extraction of gold. Cyanides frequently appear at low levels in water, deteriorating its quality. In this paper a degradation of 55.76% and 62.99% was obtained using TiO₂ catalyst and TiO₂ doped with Cu heteropololybdate respectively in 360 min of reaction, applying photodegradation with a 125 watt mercury lamp source. Most of the trials showed that the degraded compound kinetics may be adjusted to a pseudo first order model.

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DEGRADATION OF CYANIDE FROM GOLD MINING WASTEWATER USING PHOTOCATALYSIS

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ABSTRACT

In recent years, water quality issues related with hazardous wastewater and toxic substances have attracted worldwide attention. Cyanide is a major toxin in wastewater resulting from a diversity of industries, including gold mining. Cyanide has adverse health effects on people as well as other living organisms. The toxic effects of cyanide are so important to cause nerve damage and thyroid glands malfunctioning. In this paper, the degradation of cyanide in waters resulting from gold mining activity was carried out in a batch system with two catalysts TiO₂ Degussa P-25 and TiO₂ doped with copper heteropolyimolybdate, that was synthesized in laboratory and characterized by FTIR and XRD. Assays showed a degradation of 98.55% with a concentration of 0.3 g/L of TiO₂ and 97.17% with TiO₂ doped with 1% of Cu heteropolyimolybdate (1 g/L) in 50 min of reaction. A real mining sample showed a cyanide degradation of 55.76% with TiO₂ in 240 min of reaction. All the assays were made applying photodegradation using a 125-Watt mercury lamp as source. These results are encouraging to use this technology for the removal of cyanide coming from highly contaminated aqueous effluents.

Keywords:

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RISK ASSESSMENT OF PCP LIFT SYSTEM USING A FISHBONE DIAGRAM AND MICMAC METHOD

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ABSTRACT

Hydrocarbons demand by industrialized and developed nations and the oil prices conditions last few years; many companies have turned again to fields that were not previously considered attractive to produce, to identify them as an alternative to meet that demand. This research shows the identification of a condition, which should be taken into account to produce a mature field by progressive cavity pumping (PCP) artificial lift system, an evaluation with the MICMAC method and the identification of the key variables to achieve the development in this practice. The results make possible to identify highest influence elements, which can guide intervention strategies and form the basis to formulate guidelines and policies for the PCP implementation. The results allow us to conclude that pressures and mechanical designs in field wells should be the guidelines for optimum production, the market rate improvement, and the reservoir productive life.

Keywords:

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PROSPECTIVE TOWARDS IMPLEMENTATION OF ELECTRIC VEHICLES IN COLOMBIA

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ABSTRACT

The effects of climate change have led to reduces fossil fuel in vehicle, developing new technologies such as the electric vehicles. The research presents an identification of barriers and inhibitors according to international experiences, an evaluation with the MICMAC method and the identification of key factors to achieve development of electric vehicles in Colombia. The results allow to identify the elements of high influence, which may guide intervention strategies and be the basis for the formulation of guidelines and policies. The results conclude that the business models for the purchase and sale of energy are the catalyst for the encouraging of the stakeholders, the improvement of the distribution network and the management of the electricity market.

Keywords:

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OFFSHORE OIL EXPLOITATION IN THE CARIBBEAN SEA: CHALLENGES FOR COLOMBIA

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ABSTRACT

Colombia began an expansion plan for oil exploration in the Caribbean Sea, this industry is recognized for the high impact it can generate, being necessary to identify mechanisms to improve management. This research presents a review of the experiences in the offshore oil industry, describes the case of oil exploration in the Arctic, a fragile ecosystem; methodologies and indicators used to strengthen the industry in order to achieve sustainability are identified. The results allow to conclude that it is necessary to strengthen the development plan from the institutional and political frameworks using a Strategic Environmental Assessment, also they indicate how this can improve the instruments and achieve improvement in the social, economic and environmental dimensions.

Keywords:

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Artículo Completo: xxxxxxx

RETOS DE LA GESTIÓN DEL TALENTO HUMANO EN LA INDUSTRIA 4.0

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RESUMEN

Los grandes cambios de transformación de los ambientes industriales a nivel mundial traídos por la cuarta revolución industrial, también denominada Industria 4.0, han llevado consigo la necesidad de un manejo estratégico de las personas. El objetivo de este capítulo es abordar en esta investigación el análisis de los retos que tienen las nuevas empresas para visualizar la sintonía entre el crecimiento tecnológico y el talento humano. Para los fines de la indagación se llevó a cabo una metodología sistémica que dio las pautas para analizar el contexto real de trabajo sobre el tema en las bases de datos Web of Science y Scopus, al igual que una vigilancia tecnológica mediante el software de minería de datos VantagePoint. Se pudo evidenciar que con la llegada de esta nueva revolución industrial llegarán cambios drásticos en los perfiles de los trabajos, las competencias del personal y la selección del mismo que repercuten directamente en la creación de nuevas habilidades para adaptar las nuevas tecnologías, también se invita como conclusión general a analizar la gestión de personas y a discutir las diferentes problemáticas para el proceso de adaptación a nivel mundial para un mejor rendimiento. Esta tendencia involucra la formación de nuevo talento humano al sector industrial y de servicios como lo es el gobierno y los sistemas educativos.

Palabras Claves: Industria 4.0, Gestión del talento humano, Recurso Humano, Talento Humano, Operador 4.0, Fábricas inteligentes, Cuarta revolución industrial.

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COMMUNICATIONS IN FLEXIBLE SUPERVISOR FOR LABORATORY RESEARCH IN RENEWABLE ENERGY

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ABSTRACT

In laboratories new systems are created where researchers hope to obtain improved functions at a reasonable cost. In them, specialists need efficient tools that offer better performance and flexible features. This paper designs and implements a SCADA system for GERA laboratory (Scientific Group for Applied Renewable Energy at the University of Oriente) adjusted to the inherent characteristics of flexibility and functionality required in research centers. All these features are supported in an efficient communication system with the implementation of various protocols and novel solutions for this type of systems for monitoring and control. It verifies and validates the system for formal methods.

Keywords:

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DESIGN OF A FUZZY CONTROLLER FOR A HYBRID GENERATION SYSTEM

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ABSTRACT

This paper presents the design of a control system for the automatic connection/disconnection and distribution of load, between an asynchronous alternator and a generator, in a hydroelectric central that works in isolated mode. The design of a control algorithm based on fuzzy logic is exposed, as this is a flexible method to be used in different installations with a variety of technology. The controller is supported on the Arduino Mega 2560 platform, in order to develop a low-cost system with its own technology, it is tested by computer simulation using the professional software Proteus v7.7, which guarantees that once validated the correct operation of the controller can be migrated to another system, say for example a PLC. The results obtained are shown and the simulations performed to the different blocks of the system are explained.

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**A PROPOSAL FOR UPDATING THE RESPONSE SPECTRUM OF SAN JOSE DE CUCUTA,
COLOMBIA**

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ABSTRACT

An analysis of seismic signals captured in three stations of the network of accelerographs of the Colombian Geological Service (SGC, by its acronym in Spanish) was developed for the city of San Jose de Cucuta, Colombia. Earthquake Equivalent, Response Analysis (EERA) and DEGTRA4 software were used for analysis, processing and calculation of signal response spectra during the characterization and propagation modelling of the signal by profiles. For the accelerograms family, a normalization factor computed with respect to the Peak Ground Acceleration (PGA) was obtained by superposition against the typical design spectrum of the Colombian earthquake resistant code (NSR10). It was found that there is a band of frequencies above the maximum acceleration zone of the design spectrum of the current standard. This suggests a revision of the seismic threat of the city of Cucuta and the urgent need to develop the seismic microzoning, which would allow a substantial reduction of the seismic risk.

Key Word: Response Spectrum, simple oscillator, Peak Ground Acceleration (PGA).

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Artículo Completo: xxxxxxxx

**POTENTIAL ENERGY SAVINGS IN COMPRESSED AIR SYSTEMS IN INDUSTRIALIZED CITIES.
A CASE STUDY IN BARRANQUILLA AND CARTAGENA**

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ABSTRACT

The increase of energy consumption, global warming, resource depletion and the rise of policies focused on climate change and greenhouse gas emissions reductions, have promoted to countries and industries the implementation of strategies focused on increase energy efficiency and reduce GHG emissions. Compressed Air Systems (CASs) are one of the most widespread systems used in industry. In countries such as China, USA, Australia, France and Italy, CASs accounts around 10% of the overall electricity costs. In Colombia the energy used in the industrial sector, rise the 33 % of the total energy consumption, equal to 481.429 TJ/year; the electricity consumption is a 13 % of this value, equivalent to 13,3 TWh/year. This paper determine the potentials energy saving of CASs for two industrial cities of the Colombian Caribbean Coast region, showing that there is a high energy saving potential, around 50 GWh/year and a reduction of CO₂ emissions of 10,702 tons of CO₂/year, which can be taken in consideration by the government and organizations to develop projects focused on reduce energy consumption and mitigate CO₂ emissions.

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USO DE SMARTPHONE COMO FOTOCOLORÍMETRO PARA MEDIR LA ABSORBANCIA DE SUSTANCIAS COLORIDAS

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RESUMEN

Actualmente en Colombia se comercializa una gran cantidad de bebidas alimenticias, siendo las principales en su consumo la gaseosa y jugos artificiales, estas contienen colorantes artificiales que simulan el color de las frutas las cuales pueden poseer cierto grado de alergénicos, resultado de sustancias tóxicas como el amoníaco y los sulfitos que en la mayoría de los casos desconocemos cuan nociva son para la salud, afectando mayormente a los niños, dañando el ADN y con posible riesgo de cáncer.

Para realizar el análisis de la concentración de colorante se utiliza un instrumento llamado espectrómetro de luz; este tipo de tecnología no está al alcance de muchos químicos que en sus laboratorios no cuentan con estos equipos, lo cual limita el estudio para la identificación de colorante en la bebida.

Utilizando la ley de Beer Lambert, también conocida comúnmente como la ley de Beer, permite calcular la concentración de una sustancia absorbente en una solución. En los resultados de nuestro experimento se utilizan soluciones de colorante azul de alimentos, demostrando que los datos de absorbancia versus los datos de concentración son lineales para los datos obtenidos, usando teléfonos inteligentes con cámara mediante la aplicación (color grab). Para La obtención de datos confiables es necesario tomar una sola imagen por cada muestra, con un fondo blanco para que no altere el color de las muestras, El enfoque proporciona un método fácil para realizar el análisis del colorimétrico desde el laboratorio de química para introducir los conceptos de química analítica y de procesos, entre otros conceptos, a los estudiantes en numerosos campos.

Palabras Clave: Ensayo químico, Smartphone, colorimetría, ley de beer.

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USE OF TECHNOLOGICAL TOOL FOR THE CONSOLIDATION OF MATHEMATICAL PRE-KNOWLEDGE IN HIGHER EDUCATION

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ABSTRACT

Currently, information and communication Technologies (ICT) have permeated the different educational, political, economic and sociocultural contexts, contributing to the inclusion and development of society by optimizing time, efforts and resources. On the other hand, (ICT) are considered powerful facilitators of the teaching-learning process at all training levels because they visibly improve the way of acquiring knowledge, becoming essential tools for educational transformation and innovation. Therefore, the purpose of this present study is to analyze the results of the first implementation of the PREIN - UTS virtual course developed in the web Khan- Academy tool. The sample was formed by new students who entered the first semester of the technological level in the academic period 2018-II of a higher education institution located in Bucaramanga Santander (N=801). The methodological approach was quantitative of exploratory type, with the use of descriptive statistics and SPSS software for data analysis. Among the research results it was evidenced that the PREIN course is an innovative and easily accessible strategy, that contributes to the assurance of mathematical skills of the upcoming students that will enter proximally.

Keywords:

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**METHODOLOGY TO DEFINE AN INTEGRATION PROCESS BETWEEN FRAMEWORKS SCRUM,
DJANGO REST FRAMEWORK Y VUE.JS, IMPLEMENTED FOR SOFTWARE DEVELOPMENT,
FROM QUALITY MANAGEMENT APPROACH AND AGILITY**

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ABSTRACT

At present, the industry has great challenges for the construction and maintenance of software, in terms of quality, costs and time, for this it is significant to have a methodological framework, which allows the possibility of having effective and practical methods, applying programming techniques from an agile approach, which guarantees the construction of quality code from the beginning of software development. This study analyzes the integration between frameworks SCRUM [1], Django REST framework [2] and Vue.js [3], which are commonly implemented in isolation for the execution of software development projects, and components are also incorporated of the IEEE 830 standard defined for the specification of software requirements [4], and of the ISO 25000 standard for software quality assessment [5]. Likewise, the characteristics of each study framework within the software architecture are analyzed, establishing of traceability between them and obtaining as a result a methodology for the definition of a process map; where each framework is integrated and it is described the procedure for structuring the planning, development and delivery phases. Thus providing a guide for the application of programming techniques from the concept of agility and quality management, from the process of integration of the frameworks analyzed in this study.

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TELESALUD: MARCO LEGAL PARA EL DESARROLLO TECNOLÓGICO EN COLOMBIA

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RESUMEN

El avance de las tecnologías en salud, permiten a los profesionales en las ciencias de la ingeniería poder incursionar en diferentes proyectos que conllevan a desarrollos e innovaciones tecnológicas, sin embargo, estos profesionales muchas veces desconocen las normas que regulan el desarrollo e implementación de nuevas tecnologías en el campo de la salud. Por esta razón el presente capítulo tiene como objetivo describir el marco legal en Telesalud en Colombia, exponiendo las diferentes normas expedidas por los órganos del Gobierno Colombiano. Es una investigación descriptiva, basada en una revisión bibliográfica de los artículos de la constitución política del 1991, leyes, decretos, resoluciones y sentencias que ilustran los temas de salud en Colombia. Como conclusión se resalta la labor del Gobierno Colombiano por velar el cumplimiento de derechos fundamentales, como lo son la vida, la salud y seguridad social, incentivando y regulando nuevas estrategias tecnológicas con el fin de poder garantizar a todos los colombianos los servicios de salud.

Palabras Clave: Telesalud, Telemedicina, Salud, Tecnología, Normas.

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Artículo Completo: xxxxxxxx

GROWTH OPTIMIZATION OF *CHLORELLA VULGARIS* IN MIXOTROPHIC CULTURE ENRICHED WITH NUTRIENTS USING EXPERIMENTAL DESIGN

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ABSTRACT

In this research, statistical optimization designs were applied to evaluate the growth of the *Chlorella vulgaris* in mixotrophic cultures enriched with nitrogen and phosphorus. The influence of each factor was evaluated at three levels, so a multifactorial experimental design was created 32. The results obtained showed that microalgae growth improves 32% by adding 50 mg of nitrogen and 25 mg of Nitrogen to the culture. This project demonstrates the relevance of the design of experiments for the optimization of algal biomass production in order to obtain bioproducts.

Keywords:

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EVALUACIÓN DE LIMOLITA DEL GRUPO GUADALUPE PARA USO ESTRUCTURAL

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RESUMEN

Las rocas sedimentarias son materias primas con un alto valor económico para la industria de la construcción. Sin embargo, teniendo en cuenta que el 40% de los impactos ambientales son derivados de dicho sector, es de crucial importancia orientar este tipo de materiales a alternativas de aprovechamiento que podrían conducir a beneficios económicos y ambientales, que permitan reducir dramáticamente los impactos generados por la explotación y procesamiento de los mismos. En este sentido, se observa una oportunidad con las rocas sedimentarias del grupo Guadalupe, las cuales son explotadas en la sabana de Bogotá. Por consiguiente, se hace necesario incentivar las investigaciones que permitan enriquecer la incorporación de rocas origen sedimentario, en particular la limolitas, a la industria de la construcción en conjunto con alternativas sostenibles. El objetivo de este documento es el de evaluar el potencial de areniscas de la sabana de Bogotá como elementos estructurales portantes con el fin de ofrecer alternativas en la industria de la construcción. Esta investigación fue de carácter experimental y metodológicamente se propuso caracterizar mecánicamente algunas areniscas del grupo Guadalupe. Para ello, se realizaron ensayos de resistencia a la compresión no confinada (uniaxial) de acuerdo con la normatividad existente. Además, se realizó una comparación con elementos estructurales portante (adoquines) para determinar la posible aplicación para tráfico peatonal y vehicular liviano. Como resultado, se presentan lineamientos de potencial de las areniscas de la sabana de Bogotá, para su aplicación como posible elemento portante.

Palabras claves: Grupo Guadalupe, Rocas sedimentarias, Limolita, Adoquines, Elementos portantes

Modo de Publicación: Capítulo de Libro de Investigación

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BENEFITS OF THE INSTRUMENTATION, MONITORING AND CONTROL SYSTEMS (IMC) OF BRIDGES IN COLOMBIA, FROM AN ECONOMIC POINT OF VIEW THROUGH A CASE STUDY

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ABSTRACT

An instrumentation, monitoring and control (IMC) system is the result of the application of different branches of engineering such electrical, systems and telecommunications, applied to solve a problem in civil engineering, and achieving a radical innovation in the construction and the maintenance of bridges. These different branches come together to carry out activities such as the development of measurement instruments, applications for the storage and analysis of data, and the transmission thereof. This article presents the state of art about road infrastructure controls in Colombia, particularly on bridges. It summarizes some important cases of collapse with their main causes, establishing as an effective solution IMC of the bridges throughout the structures' life cycle, showing the benefits associated with the initiation of the system. In addition, an economic analysis of the installation of an IMC system is presented through a case study of one bridge located in Colombia, which has enabled us to identify and find relevant information related to those responsible for the project, the required instrumentation and the investment percentages regarding this particular type of project. The text consists of seven sections, which address the problems, instrumentation, software and personnel requirements for this type of project in Colombia, and finally to examine the associated costs.

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CONTAMINACIÓN DIFUSA; GENERALIDADES, CASOS DE ESTUDIO Y CONTEXTO COLOMBIANO

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RESUMEN

En la actualidad existen diversas fuentes de contaminación, que de acuerdo a sus características y propiedades pueden llegar a generar impactos significativos sobre el medio ambiente. La contaminación difusa, que puede presentarse sobre el suelo y llegar a diversas fuentes hídricas, es una de las más difíciles de caracterizar dada la complejidad de identificar su punto de generación y los elementos primarios que proceden del hecho contaminante. Siendo fundamental analizar las posibles fuentes y la capacidad de dispersión de los contaminantes. Esta investigación estudia diversas fuentes de contaminación en el contexto colombiano, a partir de la revisión de casos de estudio, evidenciando cómo el problema es generalizado en nuestro territorio, siendo fundamental la implementación de sistemas de monitoreo para su detección y acción efectiva.

Palabras claves: contaminación difusa, dispersión, contaminantes.

Modo de Publicación: Capítulo de Libro de Investigación

Artículo Completo: Desafíos en Ingeniería “Investigación Aplicada” - Capitulo 10;<https://expotecnologia.unitecnar.edu.co/wp-content/uploads/2020/06/Cap-Book19.pdf>

CAUSAL ANALYSIS OF THE PINION TEETH FAILURE IN A LIMESTONE RECLAIMER

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ABSTRACT

This paper presents a causal analysis of an unexpected failure of the pinion teeth of a large reducer installed in a limestone reclaimer which is part of a raw material transportation system of a cement factory. The Montano methodology is applied. It includes a collection of documentation, evidences, evaluation of failure mechanism by visual inspection and some hypothesis and their validation based on the analysis of the material resistance. It is demonstrated that although the teeth of the pinion were made of a suitable material and cemented correctly, they worked overloaded due to the presence of large rocks in the raw material. A resulting increase of contact tensions in the teeth over the allowed limits led to a fatigue failure process which is described in this work. The results of the analysis can be of great interest in order to develop preventive measures and avoid future undesired plant stoppages and economic losses.

Keywords:

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MECHANICAL EFFORT OF CERAMIC PARTICLE-REINFORCED EPOXY MATRIX USED AS A SEALING LAYER ON ALUMINUM COATINGS BY ARCO SPRAY

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ABSTRACT

The coating against the corrosion and wear of carbon steel with pure aluminum applied by thermal projection with electric arc (arc spray) presents a porous surface. This is the reason why adding a sealing with a polymer layer, regularly epoxy is necessary. However, epoxy-based sealing solutions usually do not have high performance against abrasive wear. In this research a new product has been developed in composite material with polymer matrix (PMCs), epoxy paint reinforced with ceramic particles, in order to improve the performance of this layer against abrasive wear. Preliminary runs were made with 3 variables: Epoxy matrix (2 types: epoxy S and epoxy C); Size of reinforcing ceramic particles (two levels: 1 μm 9 μm) and percentage of ceramic reinforcement (4 levels: 0%, 20 %, 33.3% and 50 %). Adhesion and abrasive wear tests were performed to show that the composite material with epoxy matrix type C, has better performance than the composite material with epoxy matrix type S. Increasing the percentage of reinforcement particles showed that the composite material with type C epoxy matrix maintained high levels of adhesion to the aluminum layer and showed an increase in abrasive wear resistance by about 60% compared to the resin without reinforcements.

Keywords:

Modo de Publicación: Revista Indexada

Artículo Completo:

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EFFECTIVIDAD DEL USO DE MINDMANAGER EN EL DESARROLLO DE LA COMPRENSIÓN LECTORA

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RESUMEN

Las instituciones educativas deben velar por desarrollar competencias en cada uno de sus estudiantes, dándoles la capacidad de ser autónomos y críticos dentro de la sociedad en la que se desempeña; la lectura se encuentra entre estos pilares, siendo una herramienta de aprendizaje importante para ellos, sin embargo, según pruebas internacionales arrojan resultados preocupantes en este aspecto en varios países incluyendo a Colombia. Por otra parte, las investigaciones recientes sobre el uso de herramientas tecnológicas en los procesos de enseñanza y aprendizaje han dado resultados positivos, es por esta razón que el objetivo de la presente investigación es evaluar la efectividad del uso de MindManager en el desarrollo de la comprensión lectora de estudiantes de séptimo grado de la Institución Educativa Dulce Nombre de Jesús de la ciudad de Sincelejo. La metodología es de diseño cuasi-experimental, tomando dos grupos (control y experimental) sin ningún proceso de pre-selección, además es de enfoque cuantitativo, donde se realizaron análisis estadísticos para comparar los resultados de ambos grupos. Los resultados hallados reflejan que el grupo experimental mostró mejores resultados que el grupo control. Se concluye que es positivo la efectividad de la herramienta MindManager en el desarrollo de la comprensión lectora, por lo que se debe seguir integrando herramientas TIC en el desarrollo de esta competencia.

Palabras claves: Comprensión lectora, MindManager, Enseñanza, Lectura, Innovación.

Modo de Publicación: Capítulo de Libro de Investigación

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