redin

UNIVERSIDAD DE ANTIOQUIA
1803

revista facultad de ingeniería

Universidad de Antioquia

December, 2015

No. 77

ISSN 0120-6230
e-ISSN 2422-2844

No. 77
December, 2015
ISSN 0120-6230
e-ISSN 2422-2844

Rector:
Mauricio Alviar Ramírez

Dean:
Carlos Alberto Palacio Tobón

Editor-in-Chief
Maryory Astrid Gómez Botero

Editorial Board
Luis Ribeiro
Geosistemas
Instituto Superior Técnico
Lisboa, Portugal

Eduardo Miró
Instituto de Investigaciones en Catálisis y Petroquímica (INCAPE, CONICET)
Santa Fe, Argentina

Octavio Armas Vergel
ETS Ingenieros Industriales Ciudad Real, Universidad de Castilla-La Mancha, España

Jean Denis Taupin
HydroSciences, Institute de recherche pour le développement
Montpellier, Francia

Román Hermida
Facultad de Informática
Universidad Complutense de Madrid,
España

Oscar Rosa Mattos
Dpto. Metalúrgica y Materiales
Universidade Federal do Rio de Janeiro, Brasil

Eduardo Sánchez
École Polytechnique Fédérale de Lausanne, Suiza

Watson Vargas Escobar
Dpto. de Ingeniería Química
Universidad de los Andes, Colombia

John Ramiro Agudelo Santamaría
Dpto. de Ingeniería Mecánica
Universidad de Antioquia, Colombia

Edwin Fabián García
Escuela Ambiental
Universidad de Antioquia, Colombia

Jorge Andrés Calderón Gutiérrez
Dpto. de Ingeniería de Materiales
Universidad de Antioquia, Colombia

Sebastián Isaza Ramírez
Dpto. Ingeniería Electrónica
Universidad de Antioquia, Colombia

Julián David Arias Londoño
Dpto. Ingeniería de Sistemas
Universidad de Antioquia, Colombia

Elena Valentina Gutiérrez Gutiérrez
Dpto. Ingeniería Industrial
Universidad de Antioquia, Colombia

Scientific Board
Jesús Casanova Kindelan
Ingeniería Energética y
Fluidomecánica, Universidad Politécnica de Madrid, España

Esteban Abad Holgado
Investigaciones Químicas y Ambientales, Consejo Superior de Investigaciones Científicas
Barcelona, España

Georgina Fernández Villagómez
Ingeniería Química
Universidad Nacional Autónoma de México

Jiahua Jack Zhu
Department of Chemical and Biomolecular Engineering
University of Akron
United States

Vijay Gupta
Mechanical and Aerospace Engineering
Biomedical Engineering
Materials Science and Engineering
University of California, Los Angeles
United States

Jean Paul Allain
Radiation Surface Science and Engineering Lab (RSEEL)
Department of Nuclear, Plasma, and Radiological Engineering
Department of Bioengineering
University of Illinois
At Urbana-Champaign, United States

Dileep Singh
Argonne National Laboratory
Argonne, Illinois, United States

Hernán E.M Carvajal
Programa de Posgraduación en Geotecnia, Universidad de Brasilia
Facultad de Minas,
Universidad Nacional de Colombia

Néstor Jaime Aguirre Ramírez
Escuela Ambiental
Universidad de Antioquia, Colombia

Administrative Assistant
Sandra Hernández Barrientos

Proofreading
Juan Fernando Zabala C.
Leidy J. Hernández Zuluaga
Juan David Ángel Gutiérrez
Andrés Mauricio Mendoza Quiroz

English Proofreading
Claudia E. Urrego Zapata

Book Cover
Image "Elements that constitute HFramework" from paper "A 360-degree process improvement approach based on multiple models" by César Jesús Pardo-Calvache, Félix Oscar García-Rubio, Mario Gerardo Piattini-Velthuis, Francisco José Pino-Correa, Maria Teresa Baldassarre

Design and layout
Departamento de Recursos de Apoyo e Informática -DRAI-
Maribel Salazar Estrada
Verónica Alexandra Correa Sierra
diagramacioningenieria@udea.edu.co

Printing
L. Vieco S.A.S.
comercial@lvieco.com

Post
Reduced postal fare N° 842

E-mail
revistaingenieria@udea.edu.co

Web site
http://aprendeenlinea.udea.edu.co/revistas/index.php/ingenieria

The contents or any other legal restriction related to the articles is responsibility of the authors.

This issue was supported by Indexed Journals Fund of the Vice-President for Research, University of Antioquia Press

Objective of Revista Facultad de Ingeniería
"The principal objective of the Revista Facultad de Ingeniería is to promote the publication of original and unpublished articles derived from experimental research, engineering simulations or review papers, developed by researchers and experts from national or international, public or private institutions."

Table of contents

Editorial....7

Barriers for innovation detected in 400 colombian businesses, based on the innovation "U" coefficient methodology
Bibiana Arango-Alzate, Jhon Wilder Zartha-Sossa, José Gamaliel Medina-Henao, Andrés Felipe Avalos-Patiño, Fabian Mauricio Velez-Salazar....9

Thermogravimetric characteristics and kinetics of pyrolysis of coal blends
Juan Manuel Barraza-Burgos, Edward Andrés García-Saavedra, Deisy Chaves-Sanchez, María Patricia Trujillo-Uribe, Francisco Javier Velasco-Charria, Jaime José Acuña-Polanco....17

Aggregation study of asphaltenes from colombian Castilla crude oil using molecular simulation
Jennifer de León-Barreneche, Bibian Alonso Hoyos-Madrigal, Wilson Antonio Cañas-Marín....25

Characterization and development of closed-form solutions for axle load spectra associated with trucks circulating the highways of Colombia
Luis Fernando Macea-Mercado, Luis Guillermo Fuentes-Pumarejo, Luis Gabriel Márquez-Díaz....32

Transmission of visible light through mortars using fluorite as a fine aggregate
Ary Alain Hoyos Montilla, Jorge Iván Tobón, Yosef Farbiarz-Farbiarz....41

Energy absorption capacity of expanded metal meshes subjected to tensile loading
Dimas José Smith-López, Carlos Alberto Graciano-Gallego, Gennifer Nataly Aparicio-Carrillo....48

Virtual test bench as a complement to study thermal area: application in vapor compression systems
Juan Manuel Belman-Flores, Juan Manuel Barroso-Maldonado, Santos Mendez-Díaz, Simón Martínez-Martínez....54

Drought and genetic programming to approach annual agriculture production normalized curves
Ariadne Sofía Drust-Nacarino, Maritza Liliana Arganis-Juaréz, Rodolfo Silva-Casarín, Edgar Gerardo Mendoza -Baldwin, Óscar Arturo Fuentes-Mariles....63

An analysis of tools for automatic software development and automatic code generation
Viviana Yarel Rosales-Morales, Giner Alor-Hernández, Jorge Luis García-Alcaráz, Ramón Zatarain-Cabada, María Lucía Barrón-Estrada....75

Requirements engineering based on knowledge: a comparative case study of the KMoS-RE strategy and the DMS process
Karla Olmos-Sánchez, Jorge Rodas Osollo, Luis Fernández Martínez, Victor Morales Rocha....88

A 360-degree process improvement approach based on multiple models
César Jesús Pardo-Calvache, Félix Oscar García-Rubio, Mario Gerardo Piattini-Velthuis, Francisco José Pino-Correa, Maria Teresa Baldassarre....95

Assessment proposal of teaching and learning strategies in software process improvement
Bell Manrique-Losada, Gloria Piedad Gasca-Hurtado, María Clara Gómez Álvarez....105

Helping organizations to address their effort toward the implementation of improvements in their software process
Mirna Ariadna Muñoz-Mata, Jezreel Mejia-Miranda, Claudia Valtierra-Alvarado....115

How small and medium enterprises can begin their implementation of ITIL?
Jose Antonio Calvo-Manzano, Lohana Lema-Moreta, Magdalena Arcilla-Cobián, Juan Luis Rubio-Sánchez....127

The impact of using a proton exchange membrane on alkaline fuel cell performance
Henry Reyes-Pineda, Ramiro René Londoño-Ramírez, Leidy Carolina Cardona-Hernández....137

An optimal high thermal conductive graphite microchannel for electronic device cooling Jorge Mario Cruz-Duarte*, Iván Mauricio Amaya-Contreras, Carlos Rodrigo Correa-Cely....143

A practical method to compute shear force and bending moment envelope curves for isostatic bridges subjected to vehicle live loads
Sulpicio Sánchez-Tizapa, Roberto Arroyo-Matus, Andrés Gama-García....153

Subject-independent acoustic-to-articulatory mapping of fricative sounds by using vocal tract length normalization
Franklin Alexander Sepúlveda-Sepúlveda, César Germán Castellanos-Domínguez, Pedro Gómez-Vilda....162

Revista Facultad de Ingeniería, Universidad de Antioquia, No 77, pp. 7, 2015

Editorial

Just a little bit more than three decades has passed since IBM introduced the personal computer (PC), and this technology started to be introduced easier into the daily life of different kind of companies. With the subsequent reduction of the computer costs during the nineties and the first decade of the current century, more and more people were able to afford a PC, and computers became one of our most important belongings. Parallel to this growth of the computer industry, the field of knowledge concerning the development of computer programs, which are actually the part that let us interact with, and extract the potential of the computers, has had perhaps, one of the fastest growing in history. Computing addresses the design of hardware and software systems for many different purposes including processing, structuring, and managing various types of information, and encompasses several subareas such as computer engineering, computer science, information systems, information technology and software engineering, each of which has its own interests and challenges.

Accordingly, during the same period, the development of information systems has gone from being the work of a reduced group of technical professionals able to interact with the hardware at a low level, to become in an structured field with well-grounded theories, not only for the construction of algorithms, but also for the design of proper physical and logical software architectures. Moreover, the size and scale of the software projects prompted the emergence of methodologies that promote organized and agile software development, since the interaction of large groups of people working on components of the same project, became imperative. Nevertheless, with a continuously growing industry, new challenges emerge every day and the academic community as well as the software companies, must keep an ongoing discussion and providing new strategies and alternative methodologies, which can respond to the new challenges.

In consequence, the present issue of the journal, includes extended versions of the some of the best papers presented at the 3rd International Conference on Software Process Improvement (CIMPS'14), which was held in Zacatecas, Zacatecas, México, during October 1-3, of 2014. The editorial board of the journal, aware of the importance of software development as a field of knowledge, of the continued growth of its industry, and of the interests of our readers, has decided to accept the invitation of the CIMPS's organizing committee, and after the peer review process, publishes five papers which address problems that arise at different stages of the software development process, and provide strategies for the improvement of such processes.

Concerning the huge development of the technologies of information and the massive way they are currently used, it is worth reviewing the issue of so-called electronic documents or digital files, terms widely used, making them generic and ambiguous. The term electronic document refers to information generated, sent, received or stored by electronic, optical or similar means [1]. An electronic record file must be understood as the record of generated, received information, stored and communicated by electronic means remaining in the media during its life cycle; It is produced by a person or entity by reason of their activities and must guarantee its authenticity and proper preservation in order to ensure its informative, legal and cultural values [2, 3]

According to the Standard NTC / ISO 15489-1, electronic documents must possess certain characteristics [4]:

Authenticity: It can be shown that the document is what it claims to be, that has been created or sent by the person who claims to have created or sent, and which has been created or sent at the time stated. The electronic record contains the same features as the rest of the records: originality, uniqueness, and probative value. The differences with the rest derive from the fact that its creation, manipulation, transmission, retrieval and reading is performed using appropriate tools either from hardware (computers, peripherals and networks) or software (operating systems, applications and communications protocols).

Integrity: It refers to the complete and unaltered electronic document character. It is necessary that a document is protected against unauthorized modification. Preventive conservation of the media to ensure the permanence of the information and the legal value of the document is one of the principles governing the management of files and therefore, the electronic record file [2, 5]

Reliability: Its content is exactly what is meant. It is a complete and accurate representation of what it witnesses and can be used to prove it. The records should be created at the time or shortly thereafter in the operation or activity which reflect, by individuals who have a direct knowledge of the facts or, automatically, by the instruments commonly used to perform the operations.

Availability: It is possible to locate, retrieve, present, interpret and read. Its presentation should show the activity that produced it. The context of the documents must be sufficiently clear and contain the information necessary for understanding the operations that created and used them. The ease of electronic record files is the main contribution of digital technology in this area of management. This feature has two dimensions. On the one hand, the speed and accuracy of search and recovery through automation instruments of description, along with the required standards. On the other hand, increasing the degree of dissemination and use of the file that provides the ability to access documents electronically within the producing institution through intranets (also providing during the production of documents the capacity to exchange, share and participate in their creation by different participants) - and from the outside by users outside the organization through Internet.

Organization: As the digital world poses new challenges to the authenticity and preservation, its emergence does not suppose a rupture with the ways of organization and access that are carried out in the current documents. Rather, information technologies while offering new possibilities and greater effectiveness and efficiency, raise the need to remain faithful to the techniques of organization. It is commonplace in both texts by high-profile researchers as well as in the recommendations of major archival organizations [6].

Julián David Arias
Editorial Board Member
Revista Facultad de Ingeniería

Maryory Astrid Gómez Botero
Editor-in-Chief
Revista Facultad de Ingeniería
Universidad de Antioquia

DOI: 10.17533/udea.redin.n77a01

References

[1] Congreso de Colombia, "Ley 527 de 1999", Diario Oficial 43673, Bogotá, Colombia, Aug. 21, 1999.

[2] M. Navarro, "Los archivos de documentos electrónicos", El profesional de la información, vol. 10, no. 12, pp. 41-45, 2001.

[3] Consejo Directivo del Archivo General de la Nación, "Acuerdo No. 060", Archivo General de la Nación, Bogotá, Colombia, Oct. 30, 2001.

[4] International Organization for Standardization (ISO), "ISO 15489-1. Información y documentación. Gestión de documentos. Parte 1. Generalidades", Norma Internacional, ISO, 2001.

[5] J. Serra, "Gestión de los documentos digitales: estrategias para su conservación", El profesional de la información, vol. 10, no. 9, pp. 4-18, 2001.

[6] A. Gilliland, Enduring paradigm, new opportunities: the value of the archival perspective in the digital environment. Washington D. C., USA: Council on Library and Information Resources, 2000.