Guest Editorial:
Outstanding Educational Experiences from REV2016

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Abstract—**This editorial introduces the first selection of papers in iJOE from the REV annual conference held in 2016. It publishes an overview of the REV coverage of issues and topics inside their papers published.**

Index Terms—**Remote engineering, virtual instrumentation education applications, collaborative environment, REV 2016, Engineering Education.**

I. INTRODUCTION

We celebrate here a new special issue of the electronic journal iJOE regarding the collaboration with REV2016, the 13th International Conference on Remote Engineering and Virtual Instrumentation.

The REV conference is the annual conference sponsored by the International Association of Online Engineering (IAOE) and the Global Online Laboratory Consortium (GOLC). IAOE is an international non-profit organization with the objective of encouraging the wider development, distribution and application of Online Engineering technologies and it's influence to the society, and GOLC is focused on promoting the development and sharing of, and research into remotely accessible laboratories for educational use.

REV 2016, the last edition of this Conference, has been the thirteenth in a series of annual events concerning the area of remote engineering and virtual instrumentation. REV 2016 offered an exciting technical program as well as academic networking opportunities during the social events in Madrid.

There were two main objectives of this Conference:

- Firstly, to discuss fundamentals, applications and experiences in the field of remote engineering and virtual instrumentation. There is an increasing of the interest of new scientific and engineering applications of remote services, education applications and collaborative environment as well as the projects being developed in this area, and the Institution and Organizations (public and privates) interest in new developments like Internet of Things, Industry 4.0, cyber security, M2M and smart objects.

- Another objective of the symposium was to discuss guidelines for education in University level for those topics including new technology applications, MOOCs, Open Resources and STEM pre-University attraction.

From the list of papers published, around 200, in REV2016 we have done a selection based on the scores provided by the peer reviewers of the Conference, considering to have a representation of the different topics proposed, and a representation of several research projects supporting the contributions, national, and European, and from the Industry, as well.

Lately we invited to the authors selected to submit an extended and different version with at least 30% of new contents. We performed all the process of paper selection inside an ad hoc joined committee with more than 30 volunteers, all of them relevant authors in the past from REV. And then proceeded to have a technical peer-review evaluation of papers of extended versions with a minimum of three reviews per paper.

We hope readers will enjoy the papers that are included in this special issue as much as we have enjoyed working on them.

Yours sincerely,
Edmundo Tovar and Manuel Castro

II. SELECTED PAPERS

In this special number we present nine new papers. Remote labs are gaining more and more importance and attention in the educational community, so the focus of the selection of these papers has been experiences that disseminate and encourage the use of remote experiments; their creation and deployment need to be simplified.

Some of these papers support the learning process the design and use of teaching scenarios proposing different ways to solve the creation and adaptation of these laboratories.

- "Hybrid models of studied objects using remote laboratories for teaching design of control systems" by M. Poliakov, T. Larionova, G. Tabunshchyk and A. Parkhomenko (Zaporizhzhya National Technical University) and Karsten Henke (Ilmenau University of Technology). They describe teaching scenarios through the extension of study objects hybrid models. Functionalities of the study objects are enriched adding technical state and environment models, allowing more complex design tasks for students and increasing a number of experiments with physical models without their modification. It was given an

example of design teaching scenario of diagnostic subsystem of a traffic light.

- "Models of Collaborative Remote Laboratories and Integration with Learning Environments", by L.F. Zapata Rivera, M. M. Larrondo Petrie (Florida Atlantic University). This paper explains how the effort towards the standardization allows the composition of more complex collaborative interactions with remote laboratories and more interoperable architectures. In particular, the UML model proposed, classifying different types of laboratories, integrates the remote laboratory with a Learning Management System (LMS) through an educational standard incorporating access models for collaborative user roles in the educational context that support synchronous and asynchronous formats

- "Assisted Creation and Deployment of Javascript Remote Experiments" by Luis de la Torre and José Sánchez (UNED), and Tiago Faustino Andrade, Pedro Sousa and Maria Teresa Restivo (University of Porto). This work is oriented to students and/or trainees fostering the collaboration among them. It presents an easy way for configuration of remote labs user interfaces exploring the training objectives of a specific course, adding a valuable insight for the integration effort of experiments. The interfaces are developed in Javascript and in this way integrated into an online course in Moodle, complementing them with all the necessary educational resources.

- "From Geiger-Counters to File Systems: Remote Hardware Access for the Operating Systems Course" by J. Wolfer and W. J. Keeler (Indiana University South Bend). This work shows the importance when designing remote laboratories experiences to consider local objectives in educational communities, including learner-centered items as learning styles, to correlate with laboratory results. The experience presented, in particular, describes the development, implementation, and deployment of an end-to-end, hardware and software, remote platform supporting the development of file systems for the Computer Science Operating Systems class. This rich experimental environment supports student projects by sharing inexpensive remote hardware for students to acquire background radiations events with a Geiger counter, transforming those events into random numbers, and providing those numbers through a custom file system.

- "An Integrated Example of Laboratories as a Service into Learning Management Systems" by Ll. Tobarra, S. Ros, R. Pastor, R. Hernández, M. Castro A. Robles-Gómez, A. C. Caminero, and J. Cano (UNED), A. Al-Zoubi (Princess Sumaya University for Technology) and M. Dmour (University of Jordan). This is another work in which the laboratory is integrated into a learning process. This is achieved through the addition of pedagogical elements into the client application of the remote laboratory or the integration of remote laboratories into the existing learning contexts. The remote laboratories, under this approach, can be seen as a set of services increasing their reusability and versatility. Each available service of their remote laboratories is fully integrated as pedagogical resources into the institutional Learning Management System (LMS), in order to be employed during the whole learning process. A fully-functional example of the integration of service-oriented remote laboratories into a LMS is presented, where the Moodle platform has been chosen as a representative LMS.

- "Innovative Tools and Processes for Mobile Communications Research and Education" by F.J. Rivas-Tocado (Keysight Technologies), A. Diaz-Zayas and P. Merino (University of Malaga). This paper shows another evolution of remote experimentation to meet demands universities to collaborate and innovate in their education styles, research tools and processes. The main discussion the authors discuss is about a wider adoption of mobile technologies as a complement to traditional instrumentation and software simulation tools for educational purposes and how it can be included in federated research environments.

Other works apply efforts in the industry to be applied in educational environments:

- "Standartization Use Case of Solid-State Laser Lab and RF&Microwave Amplifier Remote and Virtual Laboratories at Labicom" by Igor Titov (Labicom LLC), Alexander Glotov (Bauman Moscow State Technical University), Yelizarov Andrey (National Research University) and Victor Petrov (RNTORES). This paper responds to the fact that many commercial user-friendly interfaces and rich client applications are not aware of the requirements of educational institutions, and not always the software within students' projects is of very good level beyond the prototype or outside scientific research. This paper outlines a demonstration of a few remote and virtual laboratories at Labicom platform that were built of industrial quality. They outline the importance of standardization and unification in software on many layers, helpful not only for connecting external laboratories to the platform but also for unifying the software on client and lab server sides thus significantly cutting needed development resources and costs.

- "Cloud-based Design and Virtual Prototyping Environment for Embedded Systems" by S. Werner, A. Lauber, J. Becker and E. Sax (Karlsruhe Institute of Technology) and M. Koedam and K. Goossens (Eindhoven University of Technology). This paper presents a cloud-based environment supporting the user in one of the main challenges in today's system design, the design and test of Multi-Processor System-on-Chips, when short time-to-market constraints. This improves the readability, portability and maintainability of produced software. Additionally, this paper presents the benefits of using cloud-based design environments in engineers' trainings and educations.

And finally, we include one representation of papers establishing educational guidelines with Open Educational Resources and MOOCs.

- "Two experiences of blended learning process on engineering education" by A. A. Rodríguez-Sevillano, M.A. Barcala-Montejano, E. Tovar, P. López-Gallego (Technical University of Madrid). This paper has presented the work done by the teaching team in two courses focused on blended learning. In both

cases, these are courses for the degree in aerospace engineering and the subject was Helicopters. The first experience was developed as an Open Course Ware (OCW), and the second one was published as a MOOC as the evolution towards a step further.

III. ACKNOWLEDGMENT

AUTHORS

Edmundo Tovar (M'94–SM'06) received the computer engineering degree and Ph.D. degree in informatics from the Madrid Technical University (Universidad Politécnica de Madrid, UPM), Madrid, Spain, in 1986 and 1994, respectively. He is currently with the UPM as a Professor of information technology in enterprise.

He has served as an elected member of the Board of Directors of the OpenCourseWare Consortium (2009–2013), Executive Director of the OCW Office of the UPM (2008–2012), and Executive Director of the Open Education Office at UPM (2012-2016). Prof. Tovar is a member of the IEEE Education Society Board of Governors (2005–2012) and Vice President of Educational Activities and Awards (2013–2016). He was awarded the IEEE EDUCON 2011 Meritorious Service Award (jointly with Manuel Castro) of the EDUCON 2011.

Manuel Castro (M'87–SM'94–F'08) received the Industrial Engineering degree and the Ph.D. degree in Engineering from the ETSII/Madrid Polytechnic University, Spain. He received the Extraordinary Doctoral Award in the UPM and the Viesgo 1988 Award to the Doctoral Thesis improving the Scientific Research about the Industrial Process Electricity Application, as well as the 1997 and 1999 years UNED's Social Council Award for the Best Didactic Materials in Experimental Sciences. He works as researcher, coordinator and director in different projects, ranging from systems applications of simulation techniques, solar system and advanced microprocessor system simulation to telematics and distance learning applications and systems, as well as computer-aided electrical engineering (CAEE), acting now as and senior technical director.

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He belongs to the organizing committee of IEEE EDUCON, IEEE FIE (International and Europe Chair, 2000-2006), REV, TAEE and SAAEI conferences as well as program and planning committees' member and reviewer and chairman of several ones. He is co-chair of the conference EDUCON 2010, TAEE 2010 and ICECE 2005. Is co-chair of the conference FIE 2014 (Frontiers in Education Conference) organized in Madrid, Spain, by the IEEE and the ASEE, as well as of the conference REV 2016 (Remote Engineering and Virtual Instrumentation) organized in Madrid, Spain. He is co-editor of IEEE-RITA and of the Electronic Journal of Spanish Chapter of the IEEE Education Society.

He is Fellow member of IEEE (for contributions to distance learning in electrical and computer engineering education) and Past President Jr (2015-2016) of the IEEE Education Society; Founder and Past-Chairman (2004-2006) of the Spanish Chapter of the IEEE Education Society, and Chair of the IEEE Spain Section (2010-2011). IEEE Region 8 Educational Activities Subcommittee Chair (2015-2016). He has been awarded with the 2012 TAEE (Tecnologías Aplicadas a la Enseñanza de la Electrónica) to the Professional Life, the IEEE EDUCON 2011 Meritorious Service Award (jointly with Edmundo Tovar), of the EDUCON 2011 conference; 2010 Distinguished Member Award of the IEEE Education Society; 2009 Edwin C. Jones, Jr. Meritorious Service Award of the IEEE Education Society; with the 2006 Distinguished Chapter Leadership Award. He is member of the Board of the Spanish International Solar Energy Society (ISES).