NewsLetter
of CENTRO DE ELECTRÓNICA INDUSTRIAL (CEI)

July–December 2012
nr. 6

"Any effort becomes light with ongoing and steady work" **Tito Livio**

CEI is full, and we like it.

A large room full of young people, researching in different fields around electronics. It is challenging and appealing. It attracts more people. There are many causes for this. Some are major, some minor, but all count. It is the sum of everyday efforts and decisions, by all of us.

We know there are many possible indicators. We are used to external quantification, parametrization and rankings: number of projects, master & doctoral dissertations, publications in indexed journals, papers presented at conferences, etc, etc. Easy to calculate. However, the indicator that integrates all the other, and it is the reason why we are productive is the "atmosphere in the lab". Many people working, every day, in research, that is what we value, and what we care and protect.

This year for the first time in two decades, our speciality has been the most demanded by the undergraduate students. The reason might be that now we teach "Fundamental electronics" before they take the decision. We opened the lab for them, our faculty and students dedicated extra time to teach and initiate them in electronics, and they liked it. When you dedicate time and effort to people, it flourishes.

We like thinking out of the box. Electronics applied to whatever may benefit: Industry, Energy, Communications, Mobility, Health,… wherever we may help, we try, and we are supportive. Count on us!

On the personal side, we wish the very best to Roberto Prieto. His new role as VicePresident for Research at UPM is not only a recognition for his continued hard work, but an opportunity to push further research initiatives at University level. We are confident his background at CEI will be very helpful, and he will have our continuous support. Congratulations, and good luck

The editorial board

Annual 6 Meeting

MARCH 14th-15th, 2013

The sixth Annual Meeting of the CEI-UPM will take place in the ETSII-UPM on **March 14th and 15th , 2013.** As usual, the main objective this year is to show the activities at CEI and its partners.

Our Annual Meeting is an interesting networking space, a place to learn and to meet your colleagues and partners. This year we expect to continue discussions on the ever-challenging future..

Thursday afternoon (March 16th)

Opening session	Overview of CEI and Strategic Research
Conversational Discussion	*Cutting-edge technologies for the 2020 horizon*
Visiting the CEI Lab and POSTER SESSION	

Friday morning (March 15th)

Technical Sessions	CEI Session	Industry Session	Wrap-up Coctel

Monday Seminars
be aware of CEI-UPM results

More information: www.cei.upm.es/

NOV, 5 — *Application parameters update for Collection Tree Protocol based WSN applications* — **V. Roselló**

DEC, 3 — *Dependability in FPGA-Based WSNs for High Performance Applications* — **J. Valverde**

DEC, 17 — *Energy Control Method for Three-Phase Buck-Type Rectifier with very demanding dynamic loads* — **S. Zao**

Coming next....

FEB, 11 — *Multiphase Current Controlled Buck Converter with Energy Recycling Output Impedance Correction Circuit (OICC)* — **V. Svikovíć**

MARCH, 11 — *Methodology for Dynamic Stability and Robustness Analysis of Commercial-Power-Module-Based DC-Distributed Systems* — **S. Vesti**

Theses

- *Aircraft power management unit software test bench*
  Author: Guillermo Ferreiro   **Thesis Supervisor**: F. Moreno

Master Theses
Date: 26/9/2012

Doctoral Dissertation

- *Novel Inductor-less conversion strategy based on multiphase transformer-coupled converters: analysis, design and applications* by **Carmen González**
  Thesis Supervisors: J.A. Cobos & P. Alou
  Date: 28/9/2012

Book Chapter

- A. Otero, T. Cervero, E. de la Torre, S. López, G.M. Callicó, T. Riesgo and R. Sarmiento *Run-time Scalable Architecture for Deblocking Filtering in H.264/AVC and SVC Video Codecs*. in the Book: "**Embedded Systems Design with FPGAs**", Edited by P. Athanas, D. Pnevmatikatos and N. Sklavos, Springer, ISBN: 978-1-4614-1361-5, 2012

Journals

- D. He, G. Liang, J. Portilla, T. Riesgo *A Novel Method for Radio Propagation Simulation Based on Automatic 3D Environment Reconstruction,* **Radioengineering journal,** vol. 24, nº 4, pp. 985-992, December
- R. Prieto, O. García, J.A. Cobos, F.D. Gerez *Optimizing three-phase planar transformer construction,* **Bodo's Power Systems. Electronics in Motion and Conversion,** pp. 48-51, September
- D. Díaz, M. Vasic, O. García, J.A. Oliver, P. Alou, R. Prieto, J.A. Cobos, *Three-Level Cell Topology for a Multilevel Power Supply to Achieve High Efficiency Envelope Amplifier,* **IEEE Transactions on Circuits and Systems I: Regular Papers,** vol. 59, nº 9, pp. 2147-2160, September
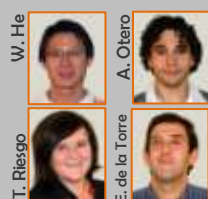
NEWS BRIEFS

- The paper "*Embedded Runtime Reconfigurable Nodes for Wireless Sensor Networks Applications*", *IEEE Sensors Journal*, Vol. 11, No. 9, September 2011 by **Y. Esteves, J. Portilla, E. de la Torre** and **T. Riesgo** was one of the 25 most downloaded Sensors Journal papers in the month of July, 2012

- Kick-off meeting of the UBICITEC associaion. UBICITEC is an association whose mission is to create synergies for the development of technhnologiy for smart cities.UPM is a founding member of the association. Duisburg, October 2012.

- The CEI-UPM has been selected as a **CUDA Teaching Center** based on your demonstrated commitment to advancing the state of parallel education using CUDA C/C++ (October, 2012)

- **W. He, A. Otero, E. de la Torre, T. Riesgo** received the Best Paper Award at the International Conference on ReConFigurable Computing and FPGAs (ReConFig), Cancún (Mexico), December 2012
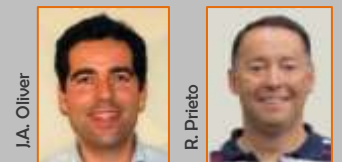
Next appointment

The Seminario Anual de Automática, Electrónica Industrial e Instrumentación 2013 (SAAEI'13) will be held, in this twentieth edition, at CEI-UPM / ETSII.

More information: http://www.saaei.org/edicion13/

July 10, 11 & 12 SAAEI 2013

- **Outgoing visiting researchers during this period**

  - **Daniel Díaz** and **Nico Hensgens**, have been doing a three-month research stay at Center of Power Electronics Systems (CPES), Virginia Polytechnic Institute and State University (Virginia Tech), Blacksburg, Virginia, USA
  - **Víctor Roselló** has been doing a three-month research stay at Tyndall National Institute, University College, Cork, Ireland.
  - **Danping He** has been doing a three-month research stay at Inria FUN Research Group, Centre de Recherche Lille, Villeneuve d'Ascq, France.

- **Congratulations** to our colleagues,
  - **Dr. Jesús A. Oliver**, who became Associate Professor in September, 2012, and
  - **Dr. Roberto Prieto** who has been promoted to Vice-president for Research of the UPM since January 1st, 2013, after being Deputy Vice-President for Research during the last six years.

- **Farewell**... to **Giuseppe Catalanotto**, he is now working at the ESA The Netherlands.

- **Welcome**... to the new CEI-UPM members who joined us during this period: **Filip Velković** from University of Belgrade (Serbia) and **Álvaro Hernández** from Instituto Tecnológico de Celaya (México); **Julio Camarero, Jorge Cortés, Airán Francés, Ángel Gallego, David Pérez, Alfonso Rodríguez** and **Mónica Villaverde** from Spain as full-time researcheers and Master students.

Julio Camarero   Jorge Cortés   Ángel Gallego

Mónica Villaverde   Airán Francés   Álvaro Hernández

David Pérez   Alfonso Rodríguez   Filip Veljković

J.A. Oliver   R. Prieto

CEI moves to biomedical applications

by J. Uceda

Some of the more advanced techniques used in the the biomedical field require the knowledge and experience available at CEI. Due to this reason, CEI is giving some steps to extend its activities in biomedical applications.

Some years ago we developed, at the beginning for "Philips Hearing Implants" and later on for "Cochlear" the contactless supply of their cochlear implants. Our background on high frequency power conversion and modelling of magnetic components helped us to improve autonomy by more than 20%. Last year we started a new activity to apply specific electric and magnetic fields to achieve water supercooling. Applications are mainly in the field of CAS (Cell Alive Systems): preserve food, tissues, and in the long term, even organs.

Recently, in close cooperation with the UPM Centre for Biomedical Technology (CTB), researchers at CEI have begun to work in new areas linked to health care and biomedical applications. In particular, the use of magnetic nanoparticles hyperthermia to damage cancerous cells is one example where our experience in the modelling of complex electromagnetic fields could be applied. At the same time, we are cooperating in the development of the power supply to generate the current waveform able to produce the desired magnetic field in a coil.

CEI is also using its experience in radio signals and 3D reconstruction of scenarios in a new cooperation with the bio-electromagnetism group. The aim is to develop new ways of representing the information of electromagnetic radiation supported by citizens to study the potential damage of large doses of RF signals in human health. Some electronic systems related with these measurement systems will be developed by CEI.

These examples show some of the emerging areas in the biomedical field where the CEI researchers can extend their activities. At the same time we have a very small experience and knowledge in the core of the biomedical field, and consequently we need to work side by side with other specialists creating multi-disciplinary research groups.

Conferences

Invited Conference

T. Riesgo, *Las Redes de sensores: una nueva oportunidad para los sistemas distribuidos de control*, **Congreso Internacional de Robótica y Automática**, November 2012, Aguascalientes (México)

SAAEI — Guimaraes (Portugal), July 2012
Seminario Anual de Automática, Electrónica Industrial e Instrumentación

V. Šviković; J. A. Oliver; P. Alou; O. García; J. A. Cobos, *Improvement of the Dynamic Performance of a Buck Converter using Controlled Current Source as an Additional Energy Path*
D. Díaz, M. Vasic, O. García, J.A. Oliver, P. Alou, J.A. Cobos, *Loss Model for a High Frequency and Low Load dc-dc Synchronous Buck Converter*.
P. M. Cheng, O. Garcia, M. Vasić, P. Alou. J.A. Oliver, G. Montoro, J.A. Cobos, *Efficiency Optimization Of Envelope Amplifier Based On The Slow-Envelope Technique*
G. Catalanotto, O. García, J. A. Oliver, P. Alou, J. A. Cobos, *Sensorless Explicit Model Predictive Control for Multi-phase Buck Converters with Variable Output Voltage*

FPL — Oslo (Norway), August 2012
International Conference on Field Programmable Logic and Applications

R. Salvador, A. Otero, J. Mora, E. de la Torre, T. Riesgo, L. Sekanina, *Implementation techniques for evolvable HW systems: virtual vs. dynamic reconfiguration*
C. Pilato, A. Cazzaniga, G. Durelli, A. Otero, D. Sciuto, M. Santambrogio, *On The Automatic Integration of Hardware Accelerators into FPGA-based Embedded Systems*

ECCE — Raleigh (North Carolina), September 2012
IEEE Conference on Energy Conversion Congress and Exposition

P. Cheng, O. García, M. Vasic, P. Alou, J.A. Oliver, G. Montoro, J.A.Cobos, *Envelope amplifier based on a hybrid series converter with the slow-envelope technique*
D. Díaz, M. Vasic, O. García, J.A. Oliver, P. Alou, J.A. Cobos, *Hybrid behavioral-analytical loss model for a high frequency and low load DC/DC buck converter*
N. Hensgens, M. Silva, J.A. Oliver, J.A. Cobos, S. Skibin, A. Ecklebe, *Optimal design of AC EMI filters with damping networks and effect on the systems power factor*

IECON — Montreal (Canada), November 2012
Annual Conference of the IEEE Industrial Electronics Society

G. Mujica, V. Rosello, J. Portilla, T. Riesgo, *Hardware-Software Integration Platform for a WSN Testbed Based on Cookies Nodes*
D. He, G. Mujica, J. Portilla, T. Riesgo, *Simulation Tool and Case Study for Planning Wireless Sensor Network*
J. Yang, J. Portilla, T. Riesgo, *Smart Parking Service based on Wireless Sensor Networks*
F. Moreno, D. Aledo, *The DLMT hardware implementation. A comparative study with the DCT and the DWT*

DCIS — Avignon (France), November 2012
Conference on Design of Circuits and Integrated Systems

G. Mujica, V. Rosello, J. Portilla, T. Riesgo, *CookieLibs: An Intuitive Software Platform For Controlling Cookies Wireless Sensor Nodes*
G. Liang, D. He, J. Portilla, T. Riesgo, *Functional validation of MB-OFDM system using HW-in the loop*

ReConFig — Cancun (Mexico), December 2012
International Conference on ReConFigurable Computing and FPGAs

W. He, A. Otero, E. de la Torre, T. Riesgo, *Automatic Generation of Identical Routing Pairs for FPGA Implemented DPL Logic*
A. Otero, E. de la Torre, T. Riesgo, *DREAMS: A Tool for the design of Dynamically Reconfigurable Embedded and Modular Systems*
Best Paper Award!!

Other

M. Lombardo, J. Camarero, J. Valverde, J. Portilla, E. de la Torre, T. Riesgo, *Power Management Techniques in an FPGA-Based WSN Node for High Performance Application*, **International Workshop on Reconfigurable Communication-centric Systems-on-Chip (ReCoSoC)**, July, York (UK)
P. M. Cheng, O. Garcia, P. Alou, J.A. Oliver, G. Montoro, J.A. Cobos, *High Efficiency Envelope Amplifier Using The Slow-Envelope Technique*, **XXVII Simposium Nacional de la Unión Científica Internacional de Radio (URSI)**, September, Elche (Alicante, Spain)
G. Liang, J. Portilla, T. Riesgo, *Low-complexity Timing Synchronization Scheme for MB-OFDM UWB Receiver Based on Sign-bit*, **International Conference on Ultra-Wideband (ICUWB)**, September, Syracuse (USA).
M. Vasić, O. García, J.A. Oliver, P. Alou, J.A. Cobos, *Survey of Architectures and Optimizations for Wide Bandwidth Envelope Amplifier*, **International Power Electronics and Motion Control Conference (EPE-PEMC, ECCE Europe)**, September, Novi Sad (Serbia)
I. Mavroidis, I. Mavroidis, I. Papaefstathiou, L. Lavagno, Mihai Lazarescu, E. de la Torre, and F. Schäfer, *FASTCUDA: Open Source FPGA Accelerator & Hardware-Software Codesign Toolset for CUDA Kernels*, **Euromicro Conference on Digital System Design**, September, Cesme, Izmir (Turkey).

Research Projects

new research projects

ITBT

APC (Audio Control Panel)

- **Prototipado virtual en SABER del sistema aeronáutico de potencia APC (ITBT)** funded by *TECNOBIT*, 1/10/2012 to 30/11/2012
  Summary.- The objective of this project is the virtual prototyping of the DC distributed power system for the APC (Audio Panel Controller). Functional and behavioral models have been developed of the main components (dc-dc converters, EMI filters, protections, loads,...) according to the requirements of "Electrical System Virtual Prototyping A400M SABER Model Requirements". These models have been verified individually with experimental measurements and globally by virtual tests (power-up, inrush current, power consumption at different input voltages, etc.).

- **Diseño y prototipado de una placa de desarrollo y caracterización de aplicaciones que se implementen en una FPGA basada en RAM,** 10/9/2012 to 22/12/2012
  Summary.- The aim of the project is to make a prospection of the features and possibilities provided by recent radiation-hardened SRAM-based FPGA technologies for their future use in space applications.

- ECOLOG. *Nueva solución de pesca integral, responsable y sostenible para la mejora de la productividad y el aprovechamiento en el sector pesquero*, funded by **Satlink** and **Mº de Economía y Competitividad**

- *Convertidores de alta velocidad de conmutacion multinivel y multifase para Aplicaciones espaciales (CAVE)*, funded by **Mº de Economía y Competitividad**, 1/1/2013 to 31/12/2016

current research projects

Modeling & Simulation of power architectures, circuits and components

- *PExprt and SMPS Library (PExpert-SMPS)* funded by ANSYS, 1/5/2007 to 1/5/2017
- *Consulting services for developing IC power module components for Simplorer* funded by **ANSYS,** 1/1/2011 to 30/6/2013
- *Modelos rápidos equivalentes para gestión de redes electrónicas de energía (MORE_GREEN)* funded by **Mº Ciencia e Innovación,** 1/1/2011 to 31/12/2013

Power Quality

- *Líderes en energías renovables oceánicas (OCEAN LÍDER)* funded by **AREVA (CENIT-E),** 2009 to 2012
- *Gestión automatizada de los datos de registradores de REE,* funded by **REE,** 1/10/2011 to 1/10/2012
- *Modelos avanzados para el estudio de la calidad de onda de enlaces en corriente continua con convertidores en fuente de tensión,* funded by **REE,** 1/10/2011 to 1/4/2013

Optimization of Power Architectures

- *Fuentes de alimentación para los imanes superconductores del XFEL europeo (XFEL)* funded by **Mº Ciencia e Innovación,** 1/12/2010 to 30/11/2013
- *PhD work in virtual optimized EMC filter design for power electronic converters under consideration of real components and interconnects (ABB-MEC)* funded by **ABB Switzerland Ltd.,** 1/3/2010 to 28/2/2013
- *Optimización de la cadena de alimentación para una aplicación radar de barrido electrónico (CARE)* funded by **INDRA SISTEMAS, S.A.,** 1/9/2011 to 31/12/2012

Integrated DC/DC Converters

- *Fuentes de alimentación con rápida respuesta dinámica para gestión de la energía (FAST)* funded by **Mº Ciencia e Innovación,** 1/1/2011 to 31/12/2013
- POWER SoC With Integrated PassivEs (PoweRswipe) funded by **European Comission FP7** 01/10/2012 to 30/9/2015

RF Amplifiers

- *Amplificadores de envolvente de banda ancha para etapas EER/ET y fabricación de dispositivos de nitruro de galio (GAN) (AEGan)* funded by **Mº Ciencia e Innovación,** 1/1/2010 to 31/12/2012
- *Advanced Wide band gap semiconductor devices for rational use of energy (RUE)* funded by **Mº Ciencia e Innovación,** 1/11/2009 to 31/10/2014

Emerging Applications

- *Starting Cryogenic Analysis (CRYOSTART)* funded by **Fidelia Group**, 1/6/2012 to 31/5/2013.

Industrial Applications

- *Shorttest: Electronics subsystem for the short circuit test of electric motor windings* funded by **BOSCH**, 1/6/2012 to 31/12/2012

Embedded Control Systems

- *Enclavamiento Electrónico de Nueva Generación (ENCE-NG)* funded by **CAF SIGNALLING S.L. (CDTI),** 1/4/2011 to 30/11/2013

Reconfigurable Embedded Systems

- *Dynamically Reconfigurable Embedded Platforms for Networked Context-Aware Multimedia Systems (DREAMS)* funded by **Mº Ciencia e Innovación**, 1/1/2012 to 31/12/2013Open
- *Source FPGA Accelerator & Hardware-Software Codesign Toolset for CUDA Kernels (FASTCUDA)* funded by **European Commission FP7-SME-2011 (Capacities),** 1/11/2011 to 31/10/2013
- *Reconfigurable Ultra-Autonomous Novel Robots (RUNNER)* funded by **Comisión Europea / CDTI / ISIS,** 1/12/2010 to 30/11/2013
- *Secure, Movile visual sensor networks ArchiTecture (SMART)* funded by **Artemis/MICyT,** 1/5/2009 to 30/4/2012.

Sensor Networks

- *Sistema de Iluminación Inteligente LUIX (TECALUM)* funded by **INNPACTO. Mº Ciencia e Innovación,** 1/11/2011 to 30/11/2014
- *ICT tools greening food processing businesses (GIST)* funded by **European Commission CIP ECO INNOVATION** 12/9/2011 to 11/9/2014
- *Tecnologías eficientes e inteligentes orientadas a la salud y al confort en ambientes interiores (TECNOCAI)* funded by **MTP (CENIT),** 1/10/2009 to 31/12/2012
- *WSN Development, Planning and Commissioning & Maintenance ToolSet ((WSN DPCM) funded by)* funded by **Artemis/MICyT,** 1/10/2011 to 30/9/2014

Telecommunications consulting

- *NetAdvanced: Despliegue de Red de Comunicaciones Avanzadas en Entornos Desfavorables* fundedn by **Mº de Industria (Program AVANZA) and Mº de Economía y Competitividad**
- *LAMP: Plataforma de Distribución y Asignación de Anuncios en nuevos Paradigmas de Acceso a TIC basada en Perfilado Anónimo de Usuarios.*, funded by **Mº Ciencia e Innovación** (Plan Innovación 2010. Program INNPACTO).