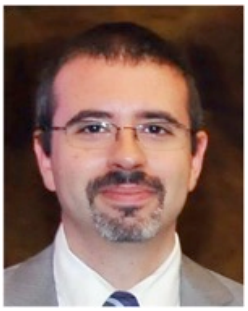
INTELEC TUTORIALS

Sunday, October 7, 2018

Lingotto Conference Centre

Rooms Parigi and Roma

TUTORIAL #1 – Sunday Oct. 7 – 10:00/13:00

Alfonso Damiano Department of Electrical and Electronic Engineering University of Cagliari (Italy)	
Alessandro Serpi Department of Electrical and Electronic Engineering University of Cagliari (Italy)	

Energy Management of Islanded Microgrid and Energy Storage Systems for Supplying Communications Systems in Critical Infrastructures

The proposed Tutorial will firstly introduce the state-of-the-art regarding the configuration of the power systems implemented for supplying the Communication Systems. In particular, standards, main technical specifications, constraints and architectures of power electronic conversion systems used for the energy conversion will be presented. Then the activity will focus on the need of increasing the distribution of communication systems in order to increase the telecommunication coverage for the expected increase of demand associated to development of IoT paradigm. In this framework, the concept of microgrid and islanded microgrid will be presented with reference to the actual state-of-the-art and considering the integration of fossil and renewable energy sources. In particular, the different energy storage systems used in Communication Systems will be presented and briefly described, focusing on their main features, model, cost and ageing. Particular attention will be then devoted to Energy Management and Conversion Systems considering specific configurations recently proposed by the speakers in order to increase the reliability and the power quality. Finally, some practical examples will be presented, after which concluding remarks and a discussion on the tutorial topics will occur.

Short Bios

Alfonso Damiano (M'11) graduated (Hons.) in electrical engineering at the University of Cagliari, Italy, in 1992. In 1994, he joined the Department of Electrical and Electronic Engineering of the University of Cagliari as an Assistant Professor. Since 2001, he has been Associate Professor of electrical machines and energy management at the same institution. In 2014 he gained the italian scientific qualification as full professor of "Electrical Energy Engineering". In 2012, during his involvement in the Italian strategic national research project CRISIS LAB, he has been Visiting Professor at Institute for Advanced Studies of Lucca, Italy. Since 2014, he has been involved, as scientific coordinator, in several international research projects regarding energy storage and e-mobility as European project Horizon 2020 "Netfficient"-grant agreement No 646463, European project Horizon 2020 "SIM4NEXUS"-grant agreement No 689150, European project FP7"ACCUS"– Grant Agreement no: 333020.
Since 2013 he has been involved, as main scientific advisor in the development and implementation of two pilots of renewable energy sources-based micro grid supported by novel energy storage management systems; the project is funded by European Community. Since 2013, he has been scientific coordinator of the Sardinian Regional Renewable Energy Laboratory. His current research interests include multiphase and high-speed electrical machines and drives, as well as modelling, management and control of electric vehicles, microgrid and energy storage systems.
He is co-author of more than 140 papers published on international conference proceedings and journals. Prof. Damiano is a reviewer for several international conferences and journals and member of IEEE IES Energy Storage Technical Committee. He was recipient of two IEEE awards. In 2013 the project "Smart City A Labelled Municipalities" received from European Commission the "Sustainable Energy Europe (SEE) and Managenergy Award 2014" where prof. Damiano has been the main scientific advisor.

Alessandro Serpi (M12)got the Master Degree in Electrical Engineering and the PhD in Industrial Engineering at the University of Cagliari, in Italy, in 2004 and 2009 respectively. From 2009 to 2015, he did research at the Department of Electrical and Electronic Engineering of the University of Cagliari as a post-doc Researcher. Since 2015, Alessandro Serpi has been an Assistant Professor at the same institution. His research activity has focused mainly on the development and implementation of advanced Model Predictive Control algorithms for permanent magnet synchronous machines by means of FPGA-based control boards. His research activity has concerned also the development and implementation of optimal/predictive control algorithms for energy storage systems for both electric propulsion systems and smart grids. Alessandro Serpi is co-author of 76 scientific publications on international journals and conference proceedings and of two book chapter. He has been involved as principal investigator, co-investigator or participant, in several regional/national/international research projects on energy storage systems, among which the NETfficient H2020 project. He was recipient of two IEEE awards. He is a reviewer for several international journals and conferences. He is a member of the editorial board of "Science Journal of Energy Engineering" and "Smart Science".

TUTORIAL #2 - Sunday Oct. 7 – 10:00/13:00

Robert (Dr. Bob) Sullivan, Ph.D.

Eminent Educator & Independent Consultant
High Density Computing and
Efficient and Effective Data Centers

Creating and Maintaining the Most Efficient and Effective Data Center

Creating the Effective and Efficient Data Center in today's Cloud and HPC computing environment, or even *in a standard enterprise facility, is mandatory in order to maximize work load and minimize operating costs. This tutorial will address areas such as team work, operation procedures, basic and advanced practices in power and cooling delivery. It will also cover the choices available to upgrade your facility or choose other solution, such as Colocation, Cloud or a combination of these. And of course IOT and Edge Computing will be addressed.*

Outline of Seminar

1) *Energy consumption in the Data Center World*
    a. *How much energy do DCs actually consume*
    b. *What the future holds*
2) *Every increasing computing and storage without an increase in energy consumption*
    a. *How is it done*
3) *Number one change to create an efficient and effective data center*
    a. *One team, one budget, one management chain*
4) *Simple best case practices that lead to an efficient data center*
    a. *Eliminate Bypass Airflow and Recirculation*
    b. *Proper layout, power distribution and cooling*
5) *Advanced best case practices that guarantee a continuing efficient data center*
    a. *Supply-side temperature control*
    b. *Variable speed motors on fans, fans ganged together*
    c. *Best case environmental controls*
    d. *Isolation of hot and cold air*
    e. *Economizer cooling*

6) *Availability, Resiliency and Redundancy – Keeping the data safe*
7) *High Performance computing, including the Hyperscale Computing and Software Defined data centers*
    a. *Hardware and software used*
    b. *Global resiliency*
8) *Cloud computing – Private, Public and Hybrid*
9) *In-house vs Colo vs Cloud*
    a. *What are the differences*
    b. *How do I decide*
10) *Edge Computing*
    a. *What it is*
    b. *How it works*
    c. *Why is it so important*
    d. *How is it implemented*

Short Bio

Dr. Sullivan received a Bachelor's degree in Mechanical Engineering from Northwestern University and Masters and PhD degrees in Experimental Applied Mechanics from Stanford University
50 Years in the IT industry, 32 with IBM and 10 with the Uptime Institute
Creator of the Hot Aisle / Cold Aisle equipment layout concept.
Identified the need to eliminate Bypass airflow and Recirculation in computer rooms.
Internationally recognized expert in critical cooling solutions as well as, computer room environments, environmental controls, hardware installation, computer room layout, power and power distribution, grounding, air flow, plus contamination identification and remediation.
For the last nine years Dr. Sullivan has concentrated on educating the IT community in the best case practices for creating and maintaining the most efficient and effective data center.
Dr. Sullivan has been honoured to be named one of "five people who changed the data center" by TechTarget in August 2010.
In April 2016 Dr. Sullivan was honoured by DataCenter Dynamics with the Contributors Award, a lifetime achievement award for his long and outstanding contribution to the data center industry.

TUTORIAL #3 - Sunday Oct. 7 – 14:00/17:00

Dorin Neacsu

Technical University of Iași, Romania

Control System Challenges in Point of Load (PoL) Converters with Power Management Bus

Starting from a comprehensive state-of-the-art description of the digital power management through Power Management Bus (PM Bus) of point-of-load converters for computer and telecom applications, this tutorial analyzes the control system problem associated to this field in respect with either dynamics or power loss. These power converters operate under special circumstances, regulating very-low voltages at very high currents, with numerous reference changes. Due to historical reasons, both analog controllers (lead-lag compensation on Type I, II, or III hardware) and digital controllers are currently used under the digital power management bus. While the design requirements are the same, different design tools may be employed for either case. This tutorial reviews design based on Venable's method for analog controllers and both the emulation method and state space based control method for digital controllers. The advantages of using a modern control method based on time-domain state-space based control are demonstrated, and a brief orientation in optimal control is pursued. The design tools are illustrated with examples, providing optimization solutions for hardware or software code, runtime, memory space, theoretical and practical performance evaluation results. The tutorial ends with a comprehensive analysis of the design and performance dependency on operating point. An advanced solution is discussed for both analog and digital setup, with a control gain change able to maintain performance with actual operation point change.

This is a very practical, hands-on tutorial, for students and practitioners, attracted by adapting and simplifying new research results into their practical systems.

Short Bio

Professor Dorin O. Neacșu received the M.Sc. and Ph.D. degrees in Electronics from the Technical University of Iași, Iași, Romania, in 1988 and 1994, respectively, and the M.Sc. degree in engineering management from the Gordon Institute for Leadership, Tufts University, Medford, MA, USA in 2005. He was involved with TAGCM-SUT, Iasi, from 1988 to 1990, and with the faculty at Department of Electronics, Technical University of Iași, between 1990 and 1999. During this time, he held visiting positions at Université du Quebec a Trois Rivières, Canada, and General Motors/Delphi, Indianapolis, USA. Following 1999, he was involved with the US industry as an Electrical Engineer, Consultant, Product Manager, and Project Manager, and with U.S. academic activities at the University of New Orleans, Massachusetts Institute of Technology, and United Technologies Research Center.

Since 2012, he is an Associate Professor with Technical University of Iași, Romania and a repeat Visiting Associate Professor with Northeastern University, Boston, MA, USA. He has maintained a continuous stream of R&D publications since 1992 within various professional organizations around the world, has organized eight professional education seminars (tutorials) at IEEE conferences, and holds three US patents. He has recently published a textbook “Telecom Power Systems” at CRC Press, along a previous book entitled "Switching Power Converters – Medium and High Power", (Boca Raton, FL, USA: CRC Press/Taylor and Francis, 2006 and 2013). Other ISBN books or college textbooks have been published in USA, Canada, and Romania. Dr. Dorin O. Neacșu received the 2015 "Constantin Budeanu" Award of the Romanian Academy of Sciences, the highest Romanian research recognition in electrical engineering. He is an Associate Editor of the IEEE TRANSACTIONS ON POWER ELECTRONICS and IEEE IES MAGAZINE, a Reviewer for the IEEE Transactions and Conferences, and a Member of various IEEE committees.

TUTORIAL #4 - Sunday Oct. 7 – 14:00/17:00

Brian Zahnstecher
PowerRox, USA

Reducing Base Station Power – A Key Enabler for 5G

By just about anyone's account, the next generation 5G network is projected to enable exponential growth in network traffic driven primarily by the public's growing hunger for streaming video and lesser so by the migration of so many other applications and data analytics to the cloud. Unfortunately, there does not seem to be as much excitement and effort around how to reduce the network-level power required to deliver this network traffic. By today's standards, the traffic growth projections are absolutely untenable based on the way power is currently distributed and utilized. When one looks at the global power footprint of all cellular networks, base stations consume an overwhelming majority of the total power. This includes the entire network, end-to-end, from core data centers to fronthaul/backhaul and even user equipment or edge devices. This implies that a major effort to reduce the power consumption of base stations is a critical enabler of the 5G network as well as the best prospect for reducing global emissions.

This tutorial is intended to provide the attendee with a thorough understanding of a base station's power architecture (yesterday, today, and tomorrow) and why it is the majority consumer of telecommunications power on the planet.

Once broken down into subsystems, each base station constituent will be analyzed for power reduction/optimization opportunities. Then, these techniques will be applied to a variety of base stations ranging from a macro cell tower to a household femtocell.

Finally, the implied power savings will be compared to what was achieved previously and reevaluated against the "Traffic Vs. Power" conundrum identified above. It is intended for Design Engineers, Network Architects, Program Managers, Data Center Architects, Data Center Managers, Business Analysts, and Marketing/Sales Personnel associated with the power supply and/or telecommunications industries.

Short Bio

Brian Zahnstecher is a Sr. Member of the IEEE, Chair of the IEEE SFBAC Power Electronics Society (PELS) awarded 2017 Best Chapter awards at the local/national/worldwide levels concurrently (an unprecedented achievement), sits on the Power Sources Manufacturers Association (PSMA) Board of Directors, and is the Principal of PowerRox, where he focuses on power design, integration, system applications, OEM market penetration, market research/analysis, and private seminars for power electronics. He leads Power for the IEEE 5G Roadmap Applications & Services Working Group, authored the Group's position paper, and has lectured on this topic at major industry conferences. He has successfully handled assignments in system design/architecting, AC/DC front-end power, EMC/EMI design/debug, embedded solutions, processor power, and digital power solutions for a variety of clients.

He previously held positions in power electronics with industry leaders Emerson Network Power (now Artesyn), Cisco, and Hewlett-Packard, where he advised on best practices, oversaw product development, managed international teams, created/enhanced optimal workflows and test procedures, and designed and optimized voltage regulators. He has been a regular contributor to the industry as an invited keynote speaker, author, workshop participant, session host, roundtable moderator, and volunteer. He has over 14 years of industry experience and holds Master of Engineering and Bachelor of Science degrees from Worcester Polytechnic Institute.

PowerRox is a firm dedicated to solving power problems for those seeking to establish or enhance their position in the enterprise and consumer power electronics marketplace. We specialize in improving efficiency, increasing reliability, achieving cost reduction through hands-on support and training/seminars/workshops. We can solve problems in power supply design, power system development, system debug and test, cost/performance analysis, marketing, and re-design. We are committed to meeting all deadlines, performing on-budget, debugging/testing solutions to required levels, and doing the highest quality work possible.