

Annual Report of Power and Energy Circuits and Systems Technical Committee 2015/2016

Compiled by Chia-Chi Chu, PECAS-TC Chair

Introduction

This report of the Power and Energy Circuits and Systems (PECAS) Technical Committee of the IEEE CAS details activities of the committee and its members of the past year. The PECAS-TC members have been involved in a large number of various activities advancing and promoting the field of PECAS.

IEEE ISCAS 2016

Regular Papers: The total number of the submitted papers was 90 (5.3% of all the submissions), out of which there were 38 accepted, which resulted in acceptance rate of 42%. The 38 accepted regular papers were organized into 5 Lecture Sessions and 2 Poster Sessions.

The following the title of sessions held at ISCAS 2016:

- ✓ Regular Sessions: 21 papers
 - DC-DC Converters : 4 papers
 - Power Converters I : 4 papers
 - Power Converters II: 4 papers
 - Power-Grid Analysis: 5 papers
 - Energy Harvesters II: 4 papers

- ✓ Poster Sessions: 17 papers
 - PECAS I: 8 papers
 - PECAS II: 9 papers

TC member activities

During the period 2015-2016 between the ISCAS2015 at Lisbon, Portugal, and the ISCAS 2016 at Montreal, Canada, the members of the PECAS-TC co-edited 2 books, wrote 3 book chapters, (co-)edited 1 special issues, organized/took part in the organization of 4 conferences and workshops, organized 1 special sessions, and delivered 5 invited lectures in major conferences and workshops related to Circuits and Systems.

1. Books written/edited

- [1]. **Luis Fernando Costa Alberto**, “Stability Regions of Nonlinear Dynamical Systems Theory, Estimation, and Applications”, co-authored with **Hsiao-Dong Chiang**, to be published, available from August 2015.
- [2]. Elena Blokhina, Dimitri Galayko, **Abdelali El Aroudi**, **Eduard Alarcon**, eds, “Nonlinear vibrational energy harvesting systems for micro- and nanoscale applications”, Springer, in press, 2016.

2. Book chapters written

- [1] **D.S. Ha**, Nano Devices and Circuit Techniques for Low-Energy Applications and Energy Harvesting, Springer, 2016.
- [2] **Hiroo Sekiya**, “Throughput and delay analysis for IEEE 802.11 multi-hop networks” in “Lecture of Information Network Science” (in Japanese), Corona-sha, Sept. 2015.

- [3] **A. El Aroudi**, M. Al-Numay, K. Al Hosani and N. Al Sayari, "Using Steady-State Response for Predicting Stability Boundaries in Switched Systems Under PWM with Linear and Bilinear Plants" in *Structural Nonlinear Dynamics and Diagnosis*, pp. 367-391, Springer, 2015.

3. Special issues edited

- [1]. **A. E. El Aroudi**, D. Giaouris, **H. H. –C. Iu**, and **I. A. Hiskens**, (Guest Editor), *IEEE Journal of Emerging and Selected Topics in Circuits and Systems: Special Issue on Design of Energy-Efficient Distributed Power Generation Systems*, Sep., 2015.

4. Editorial Services

- [1] **Philp K. T. Mok** (Associate Editor), *IEEE Trans. on Circuits and Systems- Part I*, 2016.
- [2] **Chi K. Michael Tse** (Editor in Chief), *IEEE Trans. on Circuits and Systems- Part II*, 2016.
- [3] **H. H. –C. Iu** (Associate Editor), *IEEE Trans. on Circuits and Systems- Part II*, 2016.
- [4] **Eduard Alarcon** (Deputy Editor in Chief), *IEEE Journal of Emerging and Selected Topics in Circuits and Systems*, 2016.
- [5] **Hsiao-Dong Chiang** (Senior Editor Board), *IEEE Journal of Emerging and Selected Topics in Circuits and Systems*, 2016.
- [6] **H. H. –C. Iu**, (Senior Editor Board), *IEEE Journal of Emerging and Selected Topics in Circuits and Systems*, 2016.

5. Conferences, workshops organized

- [1] **Abdelali El Aroudi**, a Program Committee member of the IEEE Latin American Symposium on Circuits and Systems (LASCAS).
- [2] **Abdelali El Aroudi**, the steering committee of International Conference on Applied Automation and Industrial Diagnostic, ICAADI 2015 Algeria.
- [3] **Abdelali El Aroudi**, the steering committee of International Conference on Power Electronics and their Applications ICPEA 2015, Algeria.
- [4] **Abdelali El Aroudi**, member of Technical Program Committee of the 3rd International Renewable and Sustainable Energy Conference (IRSEC'15), December 10-13, 2015, Marrakech & Ouarzazate, Morocco.

6. Special sessions organized

- [1] **Chia-Chi Chu** and **Luis Fernando Costa Alberto**, Special Session entitled "Emergent Applications of Advanced Nonlinear Theory in Smart Grids", *IEEE International Symposium on Circuits and Systems (ISCAS)*, May 25, 2015, Lisbon, Portugal.

7. Invited lectures delivered

- [1] **Hiroo Sekiya**, Keynote Speech at 2015 Taiwan and Japan Conference on Circuits and Systems (TJCAS 2015), Aug 20, 2015. Lecture title: Designs of High-Frequency and High-Efficiency Amplifiers: Applications of computation algorithm of bifurcation analyses to amplifier designs
- [2] **Hiroo Sekiya**, invited talk at 2015 IEEE CAS Malaysia Networking HighTea, Oct. 28, 2015. Lecture title: Analysis and design of high-frequency high-efficiency WPT systems
- [3] **Hiroo Sekiya**, invited lecture at Nanyang Technological University for IEEE Region 10 Networking, Oct 26, 2015. Lecture title: Analysis and design of high-frequency high-efficiency WPT systems

- [4] **Abdelali El Aroudi**, invited researcher in the Intensive Research Programme on Advances in Nonsmooth Dynamics held at the Centre de Recerca Matemàtica, which is a Center dedicated to improving research and advanced training in Mathematics, in collaboration with Universities and other research institutions in Catalunya Lecture title: Sliding-Mode Control and Stability Analysis of DC-DC Switching Converters.
- [5] **Abdelali El Aroudi**, invited researcher in the Intensive Research Programme on Advances in Nonsmooth Dynamics held at the Centre de Recerca Matemàtica, which is a Center dedicated to improving research and advanced training in Mathematics, in collaboration with Universities and other research institutions in Catalunya. Lecture title: What ruined the band count doubling in an AC-DC boost PFC circuit?

8. Important Journal papers from PECAS-TC

We picked 35 important journal papers related with PECAS-TC.

- [1]. E. C. Pillco and **L. F. C. Alberto**, “On the Foundations of Stability Analysis of Power Systems in Time Scales,” *IEEE Trans. on Circuits and Systems: Part I*, vol. 62, no. 5, pp. 1230-1239, 2015.
- [2]. Lin-Yu Lu and **Chia-Chi Chu**, “Consensus-Based Secondary Frequency and Voltage Droop Control of Virtual Synchronous Generators for Isolated AC Micro-grids”, *IEEE J. on Emerging and Selected Topics in Circuits and Systems*, vol. 5, no. 3, pp. 443-455, 2015.
- [3]. Lin-Yu Lu, and **Chia-Chi Chu**, “Consensus-Based Droop Control Synthesis for Multiple DICs in Isolated Micro-Grids”, *IEEE Trans. on Power Systems*, vol. 30, no. 5, pp. 2243-2256, 2015.
- [4]. Jian-Hong Liu and **Chia-Chi Chu**, “Long-Term Voltage Instability Detections of Multiple Fixed-Speed Induction Generators in Distribution Networks Using Synchrophasors”, *IEEE Trans. on Smart Grid*, vol. 6, no.4, pp. 2069-2079, July, 2015.
- [5]. Jian-Hong Liu, and **Chia-Chi Chu**, “Iterative Distributed Algorithms for Real-Time Available Transfer Capability Assessment of Multiarea Power Systems”, *IEEE Trans. on Smart Grid*, vol. 6, no. 5, pp. 2569-2578, 2015.
- [6]. **A. El Aroudi**, D. Giaouris, **H. H. -C.Iu**, and **I. A. Hiskens**, “A Review on Stability Analysis Methods for Switching Mode Power Converters”, *IEEE J. on Emerging and Selected Topics in Circuits and Systems*, vol. 5, no. 3, pp. 302-315, 2015.
- [7]. X. Xiong, **C. K. Tse**, and X. Ruan, “Bifurcation Analysis and Experimental Study of a Multi-Operating-Mode Photovoltaic-Battery Hybrid Power System” , *IEEE J. on Emerging and Selected Topics in Circuits and Systems*, vol. 5, no. 3, pp. 316-325, 2015.
- [8]. Y. Yamada, T. Nagashima, Y. Ibuki, Y. Fukumoto, T. Ikenari, and **H. Sekiya**, “Design of a DC-DC Converter With Phase-Controlled Class-D ZVS Inverter”, *IEEE J. on Emerging and Selected Topics in Circuits and Systems*, vol. 5, no. 3, pp. 354-363, 2015.
- [9]. **Hiroo Sekiya**, Xiuqin Wei, Tomoharu Nagashima, and Marian K. Kazimierczuk, “Steady-state analysis and design of class-DE inverter at any duty ratio,” *IEEE Transactions on Power Electronics*, vol. 30, no. 7, pp. 3685-3694, July 2015.
- [10]. M. Bodetto, A. Cid-Pastor, **A. El Aroudi** and L. Martínez-Salamero, “Design of AC-DC PFC High-Order Converters With Regulated Output Current for Low-Power Applications,” *IEEE Transactions on Power Electronics*, vol. 31, no. 3, pp. 2012-2025, March 2016.
- [11]. **A. El Aroudi**, D. Giaouris, K. Mandal, S. Banerjee, M. Al-Hindawi, A. Abusorrah; Y. Al-Turki, “Complex non-linear phenomena and stability analysis of interconnected powerconverters used in distributed power systems,” *IET Power Electronics*, vol. 9, no. 20, p. 855–863, April 2016.
- [12]. **A. El Aroudi**, M. Al-Numay, J. Calvente, R. Giral, E. Rodriguez and E. Alarcón, “Ripple mand

- Slope Based Indexes for Prediction of Subharmonic Oscillation in Switching Converters”, *International Journal of Electronics*, in press, 2016.
- [13]. **A. El Aroudi**, J. Calvente, R. Giral, M. Al-Numay and L. Martínez-Salamero, “Boundaries of Subharmonic Oscillations Associated to Filtering Effects of Controllers and Current Sensors in Switched Converters Under CMC”, *IEEE Transactions on Industrial Electronics*, in press, 2016.
- [14]. **A. El Aroudi**, K. Mandal, D. Giaouris, S. Banerjee, A. Abusorrah, M. Al-Hindawi, and Y. Al-Turki, “Fast-Scale Stability Limits of a Two-Stage Boost Power Converter”, *International Journal of Circuit Theory and Applications*, in press, 2016.
- [15]. D. Giaouris, K. Mandal, S. Banerje, M. Al-Hindawi, A. Abusorrah, Y. Al-Turki, **A. El Aroudi**, “Analysis of Discontinuity Induced Bifurcations in a Dual Input DC-DC Converter,” *International Journal of Bifurcation and Chaos in Applied Sciences & Engineering*; 2015, Vol. 25 Issue 5, pp. 1–10.
- [16]. R. Haroun, **A. El Aroudi**, A. Cid-Pastor, G. Garcia, C. Olalla, L. Martinez-Salamero, “Impedance Matching in Photovoltaic Systems Using Cascaded Boost Converters and Sliding-Mode Control,” *IEEE Transactions on Power Electronics*, vol. 30, no. 6, pp. 3185-3199, June 2015.
- [17]. Weiguo Lu, Naikuan Zhao, Junke Wu, **Abdelali El Aroudi** and Luowei Zhou, “Filter-based perturbation control of low-frequency oscillation in voltage-mode H-bridge DC–AC inverter”, *International Journal of Circuit Theory and Applications*, vol. 43, no. 7, pp. 866–874, July 2015.
- [18]. **A. El Aroudi**, D. Giaouris, H. H. C. Iu, I. Hiskens, “A Review on Stability Analysis Methods For Switching Mode Power Converters,” *IEEE Journal of Emerging And Selected Topics In Circuits and Systems*, vol. 5, no. 3, pp. 302-315, Sept. 2015.
- [19]. M. Bodetto, A. Marcos-Pastor, **A. El Aroudi**, A. Cid-Pastor, E. Vidal-Idiarte, “Modified Cuk converter for high-performance power factor correction applications”, *IET Power Electronics*, vol. 8, no. 10, pp. 2058–2064, 2015.
- [20]. Enric Rodriguez, **Abdelali El Aroudi**, **Eduard Alarcón** and **Herbert Iu**, “A Frequency Domain Approach for Controlling Fast-Scale Instabilities in Switching Power Converters”, in press, *International Journal of Bifurcation and Chaos*, vol. 25, no. 11. 2015, 1550141 (11 pages).
- [21]. K. Mandal, **A. El Aroudi**, Al-Hindawi, A. Abusorrah, Y. Al-Turki, D. Giaouris, **S. Banerjee**, “Nonlinear Modeling and Stability Analysis of Resonant DC-DC Converters”, *IET Power Electronics*, vol. 8, no. 12, pp. 2492-2503, 2015.
- [22]. K. Mandal and **S. Banerjee**, “Synchronization Phenomena in Microgrids With Capacitive Coupling”, *IEEE J. on Emerging and Selected Topics in Circuits and Systems*, vol. 5, no. 3, pp. 364-371, 2015.
- [23]. M. Wu, D. D.-C. Lu, and **C. K. Tse**, “Direct and Optimal Linear Active Methods for Stabilization of LC Input Filters and DC/DC Converters Under Voltage Mode Control”, *IEEE J. on Emerging and Selected Topics in Circuits and Systems*, vol. 5, no. 3, pp. 402-413, 2015.
- [24]. X. Zhang and **C. K. Tse**, “Assessment of Robustness of Power Systems From a Network Perspective”, *IEEE J. on Emerging and Selected Topics in Circuits and Systems*, vol. 5, no. 3, pp. 456-464, 2015.
- [25]. J.M. Salem and **D.S. Ha**, “Dual Use of Power Lines for Design-for-Testability (DFT) - A CMOS Receiver Design,” *IEEE Transactions on Very Large Scale Integration (VLSI) Systems*, Vol. 24, No. 3, pp. 1118 – 1125, March 2016.
- [26]. X.-D. Do, H.-H. Nguyen, S.-K. Han, **D.S. Ha**, and S.-G. Lee, “A Piezoelectric Energy Harvester with High Efficiency and Low Circuit Complexity,” *Journal of Semiconductor Technology and Science*, Vol. 15, No. 3, pp. 319-325, June 2015.
- [27]. **T. Fernando**, K. Emami, S. Yu, **H.H.-C Iu**, K.P. Wong, “A Novel Quasi-

- Decentralized Functional Observer Approach to LFC of Interconnected Power Systems,” *IEEE Transactions on Power Systems*, DOI: 10.1109/TPWRS.2015.2478968, 2015.
- [28]. S. Yu, K. Emami, **T. Fernando**, H. Iu and K. P. Wong, “Dynamic State Estimation of Doubly Fed Induction Generator Wind Turbine in Complex Power Systems”, *IEEE Transactions on Power Systems*, DOI: 10.1109/TPWRS.2015.2507620, 2015.
- [29]. K. Emami, T. Fernando, H.H.C. Iu, H. Trinh and K.P. Wong, “Particle Filter Approach to Dynamic State Estimation of Generators in Power Systems,” **IEEE Transactions on Power Systems**, vol. 30, no. 5, pp. 2665-2675, 2015.
- [30]. DongSheng Yu, **H. H.-C. Iu**, Liang Yan, **T. Fernando**, L.O. Chua, “Dynamic Behavior of Coupled Memristor Circuits”, *IEEE Transactions on Circuits and Systems-I*, vol.62, no.6, pp.1607-1616, 2015.
- [31]. W. Lu, S. Lang, L. Zhou, **H.H.C. Iu**, and **T. Fernando**, “Improvement of stability and power factor in PCM controlled boost PFC converter with hybrid dynamic compensation”, *IEEE Transactions on Circuits and Systems-I*, vol. 62, no. 1, pp. 320-328, 2015.
- [32]. K. Emami, **T. Fernando**, H. Iu, B. Nener and K. P. Wong, “Application of Unscented Transform in Frequency Control of a Complex Power System Using Noisy PMU Data”, *IEEE Transactions on Industrial Informatics*, DOI: 10.1109/TII.2015.2491222, 2015.
- [33]. Y. Zhang, H.H.C. Iu, **T. Fernando**, F Yao, K. Emami, “Cooperative Dispatch of BESS and Wind Power Generation Considering Carbon Emission Limitation in Australia,” *IEEE Transactions on Industrial Informatics*, vol.11, no.6, pp.1313-1323, 2015.
- [34]. W.Y. Leong and H. Trinh and **T. Fernando**, “A practical functional observer scheme for interconnected time-delay systems”, *International Journal of Control*, vol.88, no.10, pp.1963-1973, 2015.
- [35]. **Xiaozhe Wang**, Konstantin Turitsyn, “Data-Driven Diagnostics of Mechanism and Source of Sustained Oscillations”, *IEEE Transactions on Power Systems*, vol. 31, no. 5, pp. 4036-4046, 2016.