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Message from the Chairmen

AMPS 2017, sponsored by the IEEE Instrumentation and Measurement Society and organized by the TC39 "Measurements in Power Systems", is the 8th edition of the IEEE International workshop on Applied Measurements for Power Systems.

This year, after seven editions hosted by E.ON Energy Research Center RWTH at Aachen University, Aachen (Germany), the workshop moves for the first time to Liverpool (UK).

Building on its successful history, AMPS continues to represent a unique place for academia and industry to discuss measurement issues that are becoming more and more important in modern electric power systems, as confirmed by the growing number of papers published on this subject. The promotion of a fruitful interaction between all the relevant stakeholders is indeed the primary goal of the workshop, with the aim of exchanging knowledge, informing new research activities and facilitating the impact of research outcomes on present and future technology.

The papers presented in these proceedings have been divided into ten homogeneous technical sessions: three sessions are dedicated to Phasor Measurement Units and their applications, with a further session specifically focused on the measurement of frequency and ROCOF; two sessions deal with voltage and current sensors, along with relevant characterization techniques; two sessions consider power quality measurements, including harmonics and other issues; two sessions concern measurements on power system components, ICT infrastructure and Hardware-in-the-Loop simulations.

As usual, we hope this workshop will represent a qualified forum for highlighting problems, proposing solutions and, more in general, providing contributions to the advancement of the knowledge on these topics.

Welcome to AMPS 2017!

General Co-Chairs

Prof. Carlo Muscas - University of Cagliari - Cagliari, Italy

Prof. Lorenzo Peretto – University of Bologna - Bologna, Italy

Technical Program Co-Chairs

Prof. Antonello Monti - E.ON Energy Research Center RWTH Aachen University - Aachen, Germany

Dr. Roberto Ferrero – University of Liverpool – Liverpool, United Kingdom

IEEE AMPS 2017 Organizers

General Chairs

Carlo Muscas, University of Cagliari, Italy
Lorenzo Peretto, University of Bologna, Italy

Technical Program Chairs

Antonello Monti, E.ON Energy Research Center RWTH Aachen University, Germany
Roberto Ferrero, University of Liverpool, UK

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Ferdinanda Ponci, E.ON Energy Research Center RWTH Aachen University, Germany
Andrew Roscoe, University of Strathclyde, Scotland
Roberto Tinarelli, University of Bologna, Italy

Conference Management

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Wednesday, September 20

08:30 - 09:00

Registration

09:00 - 09:30

Welcome Address

09:30 - 11:00

Phasor Measurement Units I

Chair: Paolo Attilio Pegoraro (University of Cagliari, Italy)

09:30 Decorrelation-based Harmonic Distortion Reduction for Synchrophasor Measurements

David Macii (University of Trento, Italy)

Grazia Barchi (EURAC Research, Italy)

Daniele Fontanelli (University of Trento, Italy)

10:00 A wavelet-based transient detector for P and M class phasor measurement unit integration

Julio Barros (University of Cantabria, Spain)

Matilde de Apráiz (University of Cantabria, Spain)

Ramón I. Diego (University of Cantabria, Spain)

10:30 A modified TFT algorithm for computationally efficient PMUs

Alberto Carboni (Politecnico di Milano, Italy)

Alessandro Ferrero (Politecnico di Milano, Italy)

11:00 - 11:30

Coffee Break

11:30 - 13:00

Calibration and testing of voltage and current sensors

Chair: Carlo Muscas (University of Cagliari, Italy)

11:30 Calibration of Commercial Test Sets for Non-Conventional Instrument Transformers

Enrico Mohns (PTB, Germany)

Alessandro Mortara (METAS, Switzerland)

Hüseyin Cayci (NATIONAL METROLOGY INSTITUTE & TUBITAK UME, Turkey)

Ernest Houtzager (VSL, The Netherlands)

Soeren Fricke (PTB, Germany)

Marco Agustoni (METAS, Switzerland)

Burak Ayhan (TUBITAK UME, Turkey)

12:00 Assessment of Metrological Characteristics of Calibration Systems for Accuracy vs. Temperature Verification of Voltage Transformer

Alessandro Mingotti (University of Bologna, Italy)

Lorenzo Peretto (University of Bologna, Italy)

Roberto Tinarelli (University of Bologna, Italy)

Flavio Mauri (E-distribuzione, Italy)

Ivano Gentilini (E-distribuzione, Italy)

Wednesday, September 20

12:30 Voltage Transducers Testing Procedure Based on the Best Linear Approximation

Marco Faifer (Politecnico di Milano, Italy)
Christian Laurano (Politecnico di Milano, Italy)
Roberto Ottoboni (Politecnico di Milano, Italy)
Sergio Toscani (Politecnico di Milano, Italy)
Michele Zanoni (Politecnico di Milano, Italy)

13:00 - 14:30

Lunch

14:30 - 16:00

Harmonics

Chair: Alessandro M Ferrero (Politecnico di Milano, Italy)

14:30 Evaluation of Harmonic Distortion from Multiple Renewable Sources at a Distribution Substation

Brandon Peterson (North-West University, South Africa)
Johan Rens (North-West University, South Africa)
Jan Meyer (Technische Universität Dresden, Germany)
Gerhard Botha (North-West University, South Africa)
Jan Desmet (Ghent University, Belgium)

15:00 Harmonics Detector in Distribution Systems based on Compressive Sensing

Daniele Carta (University of Cagliari, Italy)
Carlo Muscas (University of Cagliari, Italy)
Paolo Attilio Pegoraro (University of Cagliari, Italy)
Sara Sulis (University of Cagliari, Italy)

15:30 Frequency Shifting And Filtering Algorithm for Power System Harmonic Estimation

Junhao Zhang (Hunan University, P.R. China)
He Wen (Hunan University, P.R. China)
Lu Tang (Hunan University, P.R. China)
Zhaosheng Teng (Hunan University, P.R. China)
Zhou Chen (Hunan University, P.R. China)

16:00 - 16:30

Coffee Break

Wednesday, September 20

16:30 - 17:30

Frequency and ROCOF

Chair: Julio Barros (University of Cantabria, Spain)

16:30 The Case for Redefinition of Frequency and ROCOF to Account for AC Power System Phase Steps

Andrew Roscoe (University of Strathclyde, Scotland)

Adam Dyśko (University of Strathclyde, Scotland)

Ben Marshall (National Grid, England)

Martin Lee (Scottish and Southern Electricity Networks (SSEN), Scotland)

Harold Kirkham (Pacific Northwest National Laboratory, USA)

Gert Rietveld (VSL, The Netherlands)

17:00 Improvement of mains frequency estimation robustness towards ripple control signals

Jan-Philipp Kitzig (Hochschule Ruhr West, Germany)

Gerd Bumiller (Hochschule Ruhr West, Germany)

Thursday, September 21

09:00 - 11:00

Measurements on power system components

Chair: Lorenzo Peretto (University of Bologna, Italy)

09:00 **The Improvement of System Damping by Grid Integration of PV Energy Sources**

Jan-Hendrik Hattingh (North-West University Potchefstroom Campus, South Africa)

Johan Rens (North-West University Potchefstroom Campus, South Africa)

Gerhard Botha (North-West University Potchefstroom Campus, South Africa)

09:30 **Impact of Lost Periodicity on Efficiency and Current Waveform Distortion of SMPS'**

Xiao Xu (The University of Edinburgh, Scotland)

Sasa Djokic (The University of Edinburgh, Scotland)

Roberto Langella (University of Campania "Luigi Vanvitelli", Italy)

Alfredo Testa (University of Campania "Luigi Vanvitelli", Italy)

10:00 **Low-Cost Battery Monitoring by Converter-Based Electrochemical Impedance Spectroscopy**

Roberto Ferrero (University of Liverpool, United Kingdom (Great Britain))

Chao Wu (University of Liverpool, United Kingdom (Great Britain))

Marco De Angelis (University of Liverpool, United Kingdom (Great Britain))

Hindolo George-Williams (University of Liverpool, United Kingdom (Great Britain))

Edoardo Patelli (University of Liverpool, United Kingdom (Great Britain))

Alberto Carboni (Politecnico di Milano, Italy)

Sergio Toscani (Politecnico di Milano, Italy)

Paolo Attilio Pegoraro (University of Cagliari, Italy)

10:30 **On the Measurement of Power Electronic Devices' Frequency Coupling Admittance**

Roberto Langella (University of Campania Luigi Vanvitelli, Italy)

Daniele Gallo (University of Campania Luigi Vanvitelli, Italy)

Carmine Landi (University of Campania Luigi Vanvitelli, Italy)

Mario Luiso (University of Campania Luigi Vanvitelli, Italy)

Alfredo Testa (University of Campania Luigi Vanvitelli, Italy)

Neville Watson (University of Canterbury, New Zealand)

11:00 - 11:30

Coffee Break

11:30 - 13:00

Phasor Measurement Units II

Chair: Andrew Roscoe (University of Strathclyde, United Kingdom (Great Britain))

11:30 **Employment of Interpolated DFT-based PMU Algorithms in Three-Phase Systems**

Roberto Ferrero (University of Liverpool, United Kingdom (Great Britain))

Paolo Attilio Pegoraro (University of Cagliari, Italy)

Sergio Toscani (Politecnico di Milano, Italy)

Thursday, September 21

12:00 A Low Cost PMU to Monitor Distribution Grids
Andrea Angioni (RWTH Aachen University, Germany)
Gianluca Lipari (RWTH Aachen University, Germany)
Marco Pau (RWTH Aachen University, Germany)
Ferdinanda Ponci (RWTH Aachen University, Germany)
Antonello Monti (RWTH Aachen University, Germany)

12:30 An Equivalent Synchronization for Phasor Measurements in Power Networks
Alessandro Mingotti (University of Bologna, Italy)
Lorenzo Peretto (University of Bologna, Italy)
Roberto Tinarelli (University of Bologna, Italy)

13:00 - 14:30
Lunch

14:30 - 16:00
PMU applications and testing
Chair: Johan Rens (North West University, South Africa)

14:30 Handling Instrument Transformers and PMU Errors for the Estimation of Line Parameters in Distribution Grids
Paolo Attilio Pegoraro (University of Cagliari, Italy)
Paolo Castello (University of Cagliari, Italy)
Carlo Muscas (University of Cagliari, Italy)
Kyle Brady (University of California, Berkeley, USA)
Alexandra von Meier (University of California, Berkeley, USA)

15:00 A Robust Synchrophasor-Based Method for Determining Three-Phase Line Impedance
Vladimir Mилоjevic (Institute of metrology of Bosnia and Herzegovina)
Srdan Calija (Institute of metrology of Bosnia and Herzegovina)
Milos Acanski (VSL, The Netherlands)
Gert Rietveld (VSL, The Netherlands)
Daniele Colangelo (VSL, The Netherlands)

15:30 A Testbed for the Experimental Characterization of Estimation Algorithms for Phasor Measurement Units
Daniele Gallo (University of Campania Luigi Vanvitelli, Italy)
Carmine Landi (University of Campania Luigi Vanvitelli, Italy)
Mario Luiso (University of Campania Luigi Vanvitelli, Italy)
Pietro Tosato (University of Trento, Italy)
David Macii (University of Trento, Italy)
Davide Brunelli (University of Trento, Italy)

16:00 - 16:30
Coffee Break

Thursday, September 21

16:30 - 17:30

Voltage and current sensors

Chair: Enrico Mohns (PTB, Germany)

16:30 A Novel Combined Alternate Current Sensor for Variable-Frequency Scenario

Feng Du (Siemens Ltd. China, P.R. China)

Zhen Liu (Siemens Ltd. China, P.R. China)

Weigang Chen (Siemens Ltd. China, P.R. China)

Yue Zhuo (Siemens Ltd. China, P.R. China)

Michael Anheuser (Siemens AG, Germany)

17:00 A Light Optical Current Transducer Based on Magneto Optical Isolator

Shiming Liu (Shandong University, P.R. China)

Chuanshun Fu (Shandong University, P.R. China)

Ying Zang (Shandong Electrical Engineering & Equipment Group Co., Ltd, P.R. China)

Lin Jiang (University of Liverpool, United Kingdom (Great Britain))

19:30 - 22:00

Social Dinner

Ego Restaurant

Hope Street, Liverpool L1 9BW

Friday, September 22

09:00 - 11:00

Power Quality

Chair: Roberto Langella (University of Campania "Luigi Vanvitelli", Italy)

- 09:00 **Uncertainty Evaluation for the Impact of Measurement Accuracy on Power Quality Parameters****
Etienne Gasch (Technische Universität Dresden, Germany)
Max Domagk (Technische Universität Dresden, Germany)
Robert Stiegler (Technische Universität Dresden, Germany)
Jan Meyer (Technische Universität Dresden, Germany)
- 09:30 **Challenges for Smart Electricity Meters due to Dynamic Power Quality Conditions of the Grid: a Review****
Renan Quijano (University of Strathclyde, United Kingdom (Great Britain))
Andrew Roscoe (University of Strathclyde, United Kingdom (Great Britain))
Paul Wright (National Physical Laboratory, United Kingdom (Great Britain))
- 10:00 **Minimum requirements for rapid voltage changes regulation based on their effect on flicker****
Julio Barros (University of Cantabria, Spain)
Matilde Apráiz (University of Cantabria, Spain)
Ramón I. Diego (University of Cantabria, Spain)
José J Gutiérrez (University of the Basque Country, Spain)
Puri Saiz (University of the Basque Country, Spain)
Izaskun Azcarate (University of the Basque Country, Spain)
- 10:30 **A Short-term Power Fluctuations Averaging in Low Voltage AC Grid****
Žilvinas Nakutis (Kaunas University of Technology, Lithuania)
Marius Saunoris (Kaunas University of Technology, Lithuania)
Ramūnas Ramanauskas (Kaunas University of Technology, Lithuania)
Vytautas Daunoras (Kaunas University of Technology, Lithuania)
Robertas Lukočius (Kaunas University of Technology, Lithuania)
Povilas Marčiulionis (Kaunas University of Technology, Lithuania)
Ramūnas Deltuva (Kaunas University of Technology, Lithuania)

11:00 - 11:30

Coffee Break

Friday, September 22

11:30 - 12:30

ICT and Hardware-in-the-Loop

Chair: Roberto Ferrero (University of Liverpool, United Kingdom (Great Britain))

11:30 NB PLC and Software Defined Networking for Smart Grid Applications

Stefano Rinaldi (University of Brescia, Italy)
Federico Bonafini (University of Brescia, Italy)
Paolo Ferrari (University of Brescia, Italy)
Alessandra Flammini (University of Brescia, Italy)
Dario Di Cara (National Research Council, Italy)
Nicola Panzavecchia (National Research Council, Italy)
Giovanni Tinè (National Research Council, Italy)
Antonio Cataliotti (University of Palermo, Italy)
Valentina Cosentino (University of Palermo, Italy)
Salvatore Guaiana (University of Palermo, Italy)

12:00 Validation of Algorithms to Estimate Distribution Network Characteristics Using Power-Hardware-in-the-Loop Configuration

Maria Segovia (University of Strathclyde, United Kingdom (Great Britain))
Islam Rohouma (University of Strathclyde, United Kingdom (Great Britain))
Qiteng Hong (University of Strathclyde, United Kingdom (Great Britain))
Stephane Chretien (National Physical Laboratory, United Kingdom (Great Britain))
Paul Clarkson (National Physical Laboratory, United Kingdom (Great Britain))