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CONFERENCE ABSTRACTS

2017 2nd International Conference on

Measurement Instrumentation and Electronics

(ICMIE 2017)

June 9-11, 2017 Prague, Czech Republic

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WELCOME

Dear professors and distinguished delegates,

Welcome to 2017 2nd International Conference on Measurement Instrumentation and Electronics in Prague!

We wish to express our sincere appreciation to all the Conference Chairs, Local Chairs, Technical Program Committee Chairs, Publicity Chair and Technical Committees. Their high competence and professional advice enable us to prepare the high-quality program. Special thanks to the invited speakers as well as all the authors for contributing their latest research to the conference. We hope all of you have a wonderful time at the conference and also in Prague.

The conference is featured with invited speeches, parallel sessions. One best presentation will be selected from each parallel session, evaluated from: Originality, Applicability, Technical Merit, Visual Aids, and English Delivery. Wishing you all the very best of luck with your presentations!

We believe that by this excellent conference, you can get more opportunity for further communication with researchers and practitioners with the common interest in Measurement Instrumentation and Electronics

Your suggestions are warmly welcomed for the further development of ICMIE in the future. We look forward to meeting you again next time.

Best Regards!
Yours sincerely,

ICMIE 2017 Organizing Committee
Prague, Czech Republic

NOTES & TIPS

Notes:

- Your punctual arrival and active involvement in each session will be highly appreciated.
- You are welcome to register at any working time during the conference.
- Certificate of Presentation will be awarded after your presentation by the session chair.
- One *Best Presentation* will be selected from each parallel session and the author of best presentation will be announced and awarded when the session is over.
- Please kindly keep your Paper ID in mind so that the staff can quickly locate your registration information onsite.
- Please kindly make your own arrangements for accommodations.
- Please keep all your belongings (laptop and camera etc.) with you in the public places, buses, metro.

Warm Tips for Oral Presentation:

- Get your presentation PPT or PDF files prepared.
- Regular oral presentation: 15 minutes (including Q&A).
- Laptop (with MS-Office & Adobe Reader), projector & screen, laser sticks will be provided by the conference organizer.

KEYNOTE

Prof. Ing. Jiří Tůma
Technical University of Ostrava, Czech Republic

Prof. Ing. Jiří Tůma, CSc. graduated from the Brno University of Technology, Czech Republic, in 1970 (M.Sc.) and completed his doctoral studies in 1977 (CSc., an equivalent to Ph.D.). After graduation, he became a researcher in the field of control systems at a research institute and in 1988 he began working in the R&D department of an automotive company (Tatra Trucks). In 1995, he joined the VSB - Technical University of Ostrava, Faculty of Mechanical Engineering where he became a full professor in the field of Machine and process control in 2001. He gives lectures and is doing research in the field of control systems, signal processing, active vibration control of mechanical structures, and diagnostics of rotary machines. He has authored more than 200 publications, including books. The first book deals with signal processing with the use of FFT (Sdělovací technika 1997, in Czech), and the second one deals with Vehicle gearbox noise and vibration (Wiley 2014). As one of 130 co-authors from around the world he was recruited by prof. Crocker to complete a chapter of Handbook on noise and vibration control (Wiley 2007).

Prof. Tůma's research work is focused on signal processing in the field of machine diagnostics, especially on the issue of uniformity of rotation and angular vibration with the use of order tracking analysis and on active vibration control. His research results with citations are related primarily to noise and vibration of gearboxes, Vold-Kalman order tracking filtration and active vibration control of journal bearings.

KEYNOTE

Prof. Dr.-Ing. Axel Sikora
Offenburg University of Applied Sciences, Germany
Hahn-Schickard, Germany

Dr.-Ing. Axel Sikora holds a diploma of Electrical Engineering (M.Sc.) and a diploma of Business Administration (M.B.A), both from Aachen Technical University. He has done a Ph.D. in Electrical Engineering at the Fraunhofer Institute of Microelectronics Circuits and Systems, Duisburg, with a thesis on SOI-technologies. After various positions in the telecommunications and semiconductor industry, he became a professor at the Baden-Wuerttemberg Cooperative State University Loerrach in 1999. In 2011, he joined Offenburg University of Applied Sciences, where he leads the Institute of Reliable Embedded Systems and Communication Electronics (ivESK). Since 2016, he is additionally active as head of the business unit "software solutions" and deputy director of Hahn-Schickard in Villingen-Schwenningen (Germany), one of the leading state-funded research institutes for the Internet of Things.

His major interest is in the system development of efficient, energy-aware, autonomous, secure, and value-added algorithms and protocols for wired and wireless embedded communication. Dr. Sikora is author, co-author, editor and co-editor of several textbooks and more than two hundred papers in the field of embedded design and wireless and wired networking. Amongst many other duties, he serves as member of the Steering Board of Embedded World Conference (Europe's largest conference on embedded systems) and as Scientific Advisor to the annual Wireless Congress

KEYNOTE

Prof. Dr. David Macii
University of Trento, Italy

David Macii received the M.S. degree in Electronic Engineering and the Ph.D. degree in Information Engineering from the University of Perugia, Italy, in 2000 and 2003, respectively. He was a visiting researcher at the University of Westminster, London, U.K., in 2002, and at the Advanced Learning and Research Institute (ALARI) of the University of Lugano, Switzerland, between 2003 and 2005. Between 2005 and 2012 he was an Assistant Professor with the Department of Information Engineering and Computer Science of the University of Trento, Italy. Between 2009 and 2010, he was a Fulbright Research Scholar at the Berkeley Wireless Research Center (BWRC) of the University of California at Berkeley, USA. Currently, he is an Associate Professor with the Department of Industrial Engineering of the University of Trento.

He was a General Chair and a Technical Program Chair of the IEEE EESMS Workshop in 2013 and 2015, respectively. Also, he was work-in-progress Co-chair of the IEEE SIES Workshop in 2012. Currently, he is a member of the Technical Program Committees of several IEEE Workshops and Conferences and he is a member of the TC-10 and TC-37 of the IEEE Instrumentation and Measurement Society.

David Macii is author and co-author of about 110 peer-reviewed papers published in scientific journals, books and international conference proceedings. His research interests include estimation techniques based on digital signal processing and embedded measurement systems for mechatronic and energy monitoring applications.

PLENARY

Dr. Pavel Kucera
Eaton European Innovation Center (EEIC) in Prague, Czech Republic

Pavel Kucera received his master degree (MSc.) and Ph.D. degree in Cybernetics, Automation and Measurement both from the Technical University in Brno in 2000 and 2004 respectively. In 2004, he joined Centre of Applied Cybernetics (CAK) as a researcher, where he has been working on several industrial research and development projects. From 2004-2005 for Vitkovice Machinery Group: Real time Monitoring System of a Pilger Mill, from 2006-2008 for Siemens Turbomachinery: Real-time Simulator of a Middle Pressure Steam Turbine and Reliability Model of a Turbine Protection System, from 2009-2011 for Trinec Iron and Steel Works: Real-time Monitoring System of Continual Steel Casting Process and Real-time Model of Cast Solidification. In 2012, he joined Department of Control and Instrumentation at the Technical University in Brno where he worked as an assistant professor in the area of real time embedded system and fault-tolerant systems. Since 2016, he joined Eaton European Innovation Center where he works as a senior Safety and Fault Tolerance Engineer.

AGENDA

<June 9, 2017>

Entrance Hall	
10:00-15:00	Registration & Materials Collection
15:00-16:30	Lab visit in CVUT

<June 10, 2017>

Gallery		
09:00-09:10	**Opening Remarks**	**Local Chair-Dr. Pavel Kucera** Eaton European Innovation Center (EEIC) in Prague, Czech Republic
09:10-09:50	**Keynote Speech I**	**Prof. Ing. Jiří Tůma** Technical University of Ostrava, Czech Republic Speech Title: ***Piezoelectric actuators in the active vibration control system of journal bearings***
09:50-10:20	**Coffee Break & Group Photo**	
10:20-11:00	**Keynote Speech II**	**Prof. Dr. David Macii** University of Trento, Italy Speech Title: ***Distributed synchronous measurement systems for smart grids: opportunities and challenges***
11:00-11:40	**Keynote Speech III**	**Prof. Dr.-Ing. Axel Sikora** Offenburg University of Applied Sciences, Germany Hahn-Schickard, Germany Speech Title: ***Cyber Physical Systems: game-changers for Industry 4.0***
11:40-12:10	**Plenary Speech**	**Dr. Pavel Kucera** Eaton European Innovation Center (EEIC) in Prague, Czech Republic Speech Title: ***Scalable and Modular MIL Simulations***

Lunch Time <12:10-13:30> Location: Atrium

AGENDA

Afternoon< June 10, 2017>

13:30-16:00	**Session I- Electronic information and Communication Engineering**	**Gallery**
	ME001-A ME016 ME017 ME018 ME020 ME024 ME025 ME026 ME035 ME015	

Coffee Break <16:00---16:15>

16:15-18:30	**Session II- Measurement system and Electrical automation**	**Gallery**
	ME003-A ME006 ME007 ME008 ME010 ME011 ME030 ME031-A ME033	

Dinner <18:30-20:00> **Location: Atrium**

<June 11, 2017>

09:30-17:00	Social Program (Excursion)

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June 10, 2017

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<tr><td colspan="2">OPENING & SPEECHES
Time: 09:00-12:10
Location: Gallery</td></tr>
<tr><td>09:00-09:10
OPENING
REMARKS</td><td>Dr. Pavel Kucera
Eaton European Innovation Center (EEIC) in Prague, Czech Republic</td></tr>
<tr><td>09:10-09:50
KEYNOTE
SPEECH I</td><td>Title-Piezoelectric actuators in the active vibration control system of journal bearings

Jiří Tůma
Technical University of Ostrava, Czech Republic

Abstract-The advantage of journal hydrodynamic bearings is high radial load capacity and operation at high speeds. The disadvantage is the excitation of vibrations, called an oil whirl, after crossing a certain threshold of the rotational speed. The mentioned vibrations can be suppressed using the system of the active vibration control with piezoactuators which move the bearing bushing in two directions. Motion of the bearing bushing is controlled by a feedback controller, which responds to the change in position of the bearing journal with respect to the bearing housing. Two stacked linear piezoactuators are used to actuate the position of the bearing journal. The position of the journal or shaft is sensed by a pair of capacitive sensors. This new bearing enables not only to damp vibrations, but also serves to maintain the desired bearing journal position with accuracy of micrometers. The paper will be focused on the problems of the controlled system model, the closed-loop stability, the design of the piezoactuator frame and the controller parameter setting.</td></tr>
<tr><td colspan="2"> 
Coffee break & group photo
09:50---10:20</td></tr>
</table>

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10:20-11:00 KEYNOTE SPEECH II	**Title-Distributed synchronous measurement systems for smart grids: opportunities and challenges** **Prof. Dr. David Macii** University of Trento, Italy Abstract-One of the most important benefits of smart grids is their capability to support the increasing penetration of both storage systems and renewable-based distributed energy resources (DERs), while handling efficient bidirectional power flows between multiple prosumers. At the moment, part of this transformation is already ongoing, as confirmed by several pilot projects both in Europe and in the rest of the world. Nevertheless, many challenges still need to be addressed, especially at the distribution level, which is usually poorly instrumented, since the monitoring needs of traditional passive, radial distribution grids are quite limited and are mainly oriented to fault detection only. In the near future, the diffusion of active distribution grids with a mesh topology is expected to change the requirements of measurement and control equipment considerably. In particular, safe, efficient and reliable bidirectional power flows will rely on distributed voltage and current measurements performed both at the same time and in real-time. In this respect, the so-called Phasor Measurement Units (PMUs) will play a key role. This talk will provide an overview of some cutting-edge technologies and algorithms to perform accurate and distributed synchronous measurements in smart grids. Several complementary topics will be discussed during the talk, ranging from regulatory and technical aspects to recent advances on clock synchronization and signal processing techniques for phasor, frequency and rate of change of frequency (ROCOF) estimation in power systems. Finally, the importance of synchronous measurements at the grid level will be clarified in a specific applicative context, i.e. for Distribution System State Estimation (DSSE).
11:00-11:40 KEYNOTE SPEECH III	**Title-Cyber Physical Systems: game-changers for Industry 4.0** **Prof. Dr.-Ing. Axel Sikora** Offenburg University of Applied Sciences, Germany Hahn-Schickard, Germany Abstract-In a cyber-physical system (CPS) the computational and physical elements closely interact. CPS are designed as a network of interacting elements with physical input and output instead of as standalone devices, mostly together with some backend Internet based capabilities. This extension over legacy embedded systems allows a next round in distributed intelligence for a very broad range of applications, i.e. for instrumentation and measurement. Improved observability and controls through online condition monitoring don't only allow functions like predictive maintenance, but enable completely new servicification

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	models.The presentation gives a short overview on the historical development of CPS, discusses selected applications and projects in detail, shows possible solutions for today's problems, and envisages interesting R&D directions of tomorrow.
11:40-12:10 PLENARY SPEECH	**Title-Scalable and Modular MIL Simulations** **Dr. Pavel Kucera** Eaton European Innovation Center (EEIC) in Prague, Czech Republic Abstract-Embedded systems are usually application specific and designed to meet special requirements of the target system in which they are embedded. Such systems often create huge value and unprecedented risk for a costumer. In safety critical systems, faults and errors can cause life-threating situations and therefore strict requirements are demanded in order to mitigate risks. Operation of wide range embedded systems (Automotive, Healthcare, Industrial, Military, Aerospace, etc.) is also a subject of national regulations which significantly increases the development time and cost of the system. While increasing computer power makes more technological functions possible, a bottleneck might exist in the ability to program, integrate, verify and validate these functions with respect to functional safety. Model Based Design (MBD) and Model in the Loop (MIL) simulations could significantly reduce complexity of software functions implementation, integration, verification and validation. There are available many MIL simulators on the market; however some modular and scalable solution that could meet project requirements from a small to a large scale project is still missing. We would like to demonstrate how to build a scalable and modular MIL simulator that is based on an MBD approach and that could meet requirements for wide range of embedded systems.

Lunch Time: 12:10-13:30 Location: Atrium

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Session I

Electronic information and Communication Engineering

Time: 13:30-16:00

Location: Gallery

Chaired by Prof. Jung Keun Lee, Hankyong National University, Korea

ME001 13:30-13:45	Fusion of Inertial and Barometric Sensors for Estimation of Vertical Trajectory **Jung Keun Lee** and Mi Jin Choi Department of Mechanical Engineering, Hankyong National University, Anseong, 17579, Korea Abstract- Although the integration of inertial sensors with GPS (global positioning system) is commonly used for outdoor trajectory measurements, estimation accuracy of the vertical trajectory is unacceptable for many applications when a consumer-grade GPS is applied. One solution to this issue is to fuse a barometric pressure sensor (or a barometer) instead of a GPS with inertial sensors. A barometer provides altitude information via pressure measurements, but the significant noise mixed in the barometer signals hinders its usefulness as an vertical position sensor. On the other hand, the inertial sensor has high sampling rates and may provide the vertical position via double integration of the vertical acceleration. However, the accumulation of the estimation errors in the acceleration is not avoidable and causes boundless drift in the position estimation. Hence, both signals have their own pros and cons. This research deals with the two-step Kalman/complementary filter for estimation of vertical position and velocity based on fusion of inertial and barometric sensors. The two-step filter is composed of (i) a Kalman filter that estimates vertical acceleration via attitude orientation of the sensor using the inertial sensor signals and (ii) a complementary filter that estimates vertical position using the barometer signal and the vertical acceleration from the first step. Compared with the barometer signals only, the experimental results show significant improvement in vertical trajectory tracking accuracy by applying the proposed method (i.e., ratio of the proposed method to the barometer only in terms of root mean squared error is 53%).
ME016 13:45-14:00	Dynamic mapping of EDDL device descriptions to OPC UA **Kofi Atta Nsiah**, Manuel Schappacher, and Axel Sikora Institute of Reliable Embedded Systems and Communication Electronics (ivESK), Offenburg University of Applied Sciences, 77652 Offenburg, Germany Abstract. OPC UA (Open Platform Communications Unified Architecture) is already a

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	well-known concept used widely in the automation industry. In the area of factory automation, OPC UA models the underlying field devices such as sensors and actuators in an OPC UA server to allow connecting OPC UA clients to access device-specific information via a standardized information model. One of the requirements of the OPC UA server to represent field device data using its information model is to have advanced knowledge about the properties of the field devices in the form of device descriptions. The international standard IEC 61804 specifies EDDL (Electronic Device Description Language) as a generic language for describing the properties of field devices. In this paper, the authors describe a possibility to dynamically map and integrate field device descriptions based on EDDL into OPCUA.
ME017 14:00-14:15	Development of Thread-compatible Open Source Stack **Lukas Zimmermann**, Nidhal Mars, Manuel Schappacher, Axel Sikora Institute of Reliable Embedded Systems and Communication Electronics, University of Applied Sciences Offenburg, D77652 Offenburg, Germany Abstract. The Thread protocol is a recent development based on 6LoWPAN (IPv6 over IEEE 802.15.4), but with extensions regarding a more media independent approach, which – additionally – also promises true interoperability. To evaluate and analyse the operation of a Thread network a given open source 6LoWPAN stack for embedded devices (emb::6) has been extended in order to comply with the Thread specification. The implementation covers Mesh Link Establishment (MLE) and network layer functionality as well as 6LoWPAN mesh under routing mechanism based on MAC short addresses. The development has been verified on a virtualization platform and allows dynamical establishment of network topologies based on Thread's partitioning algorithm.
ME018 14:15-14:30	Legacy to Industry 4.0 : A Profibus Sniffer **Fesseha Tsegaye Mamo**, Axel Sikora, Christoph Rathfelder Hahn-Schickard, Software Solutions, 78052 Villingen-Schwenningen, Germany Abstract. Legacy industrial communication protocols are proved robust and functional. During the last decades, the industry has invented completely new or advanced versions of the legacy communication solutions. However, even with the high adoption rate of these new solutions, still the majority industry applications run on legacy, mostly fieldbus related technologies. Profibus is one of those technologies that still keep on growing in the market, albeit a slow in market growth in recent years. A retrofit technology that would enable these technologies to connect to the Internet of Things, utilize the ever growing potential of data analysis, predictive maintenance or cloud-based application, while at the same time not changing a running system is fundamental.
ME020 14:30-14:45	Detection of grapes in natural environment using HOG features in low resolution

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	images **Pavel Škrabánek** and Filip Majerík Faculty of Electrical Engineering and Informatics, University of Pardubice, Studentská 95, 532 10 Pardubice, Czech Republic Abstract. Detection of grapes in real-life images has importance in various viticulture applications. A grape detector based on an SVM classifier, in combination with a HOG descriptor, has proven to be very efficient in detection of white varieties in high-resolution images. Nevertheless, the high time complexity of such utilization was not suitable for its real-time applications, even when a detector of a simplified structure was used. Thus, we examined possibilities of the simplified version application on images of lower resolutions. For this purpose, we designed a method aimed at search for a detector's setting which gives the best time complexity vs. performance ratio. In order to provide precise evaluation results, we formed new extended datasets. We discovered that even applied on low-resolution images, the simplified detector, with an appropriate setting of all tuneable parameters, was competitive with other state of the art solutions. We concluded that the detector is qualified for real-time detection of grapes in real-life images.
ME024 14:45-15:00	Impact of corpus domain for sentiment classification: An evaluation study using supervised machine learning techniques Redouane Karsi, **Mounia Zaim** and Jamila El Alami Laboratory of System Analysis, Information Processing and Integrated Management, Mohammadia School of Engineers, Mohammed V University, Rabat, Morocco Abstract. Thanks to the development of the internet, a large community now has the possibility to communicate and express its opinions and preferences through multiple media such as blogs, forums, social networks and e-commerce sites. Today, it becomes clearer that opinions published on the web are a very valuable source for decision-making, so a rapidly growing field of research called "sentiment analysis" is born to address the problem of automatically determining the polarity (Positive, negative, neutral,…) of textual opinions. People expressing themselves in a particular domain often use specific domain language expressions, thus, building a classifier, which performs well in different domains is a challenging problem. The purpose of this paper is to evaluate the impact of domain for sentiment classification when using machine learning techniques. In our study three popular machine learning techniques: Support Vector Machines (SVM), Naive Bayes and K nearest neighbors(KNN) were applied on datasets collected from different domains. Experimental results show that Support Vector Machines outperforms other classifiers in all domains, since it achieved at least 74.75% accuracy with a standard deviation of 4,08.

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ME025 15:00-15:15	Implementation in an FPGA circuit of Edge detection algorithm based on the discrete wavelet transforms Issam Bouganssa, **Mohamed Sbihi** and Mounia Zaim Laboratory of System analysis, information processing and integrated management, High School of Technology SALE, Mohammed V University in Rabat MOROCCO. Abstract: The 2D Discrete Wavelet Transform (DWT) is a computationally intensive task that is usually implemented on specific architectures in many imaging systems in real time. In this paper, a high throughput edge or contour detection algorithm is proposed based on the discrete wavelet transform. A technique for applying the filters on the three directions (Horizontal, Vertical and Diagonal) of the image is used to present the maximum of the existing contours. The proposed architectures were designed in VHDL and mapped to a Xilinx Sparten6 FPGA. The results of the synthesis show that the proposed architecture has a low area cost and can operate up to 100 MHz, which can perform 2D wavelet analysis for a sequence of images while maintaining the flexibility of the system to support an adaptive algorithm.
ME026 15:15-15:30	Impact of Machine Virtualization on Timing Precision for Performance-critical Tasks **Kirill Karpov**, Irina Fedotova and Eduard Siemens Anhalt University of Applied Sciences - Faculty of Electrical, Mechanical and Industrial Engineering, Bernburger Str. 57, 06366, Köthen, Germany Abstract. In this paper we present a measurement study to characterize the impact of hardware virtualization on basic software timing, as well as on precise sleep operations of an operating system. We investigated how timer hardware is shared among heavily CPU-, I/O- and Network-bound tasks on a virtual machine as well as on the host machine. VMware ESXi and QEMU/KVM have been chosen as commonly used examples of hypervisor- and host-based models. Based on statistical parameters of retrieved distributions, our results provide a very good estimation of timing behavior. It is essential for real-time and performance-critical applications such as image processing or real-time control.
ME034 15:30-15:45	Fully-Differential Digitally-Programmable Quadrature Oscillator using DCCDVCC Parveen Beg, **Mohd. Samar Ansari**, Iqbal A. Khan Department of Electronics Engineering Aligarh Muslim University, India Abstract. This paper presents a fully-differential digitallyprogrammable quadrature oscillator (FDDPQO). The proposed circuit is based on a recently introduced active element viz. the digitally current controlled differential voltage current conveyor (DCCDVCC). It employs five DCCDVCCs, two capacitors and a resistor. The condition of oscillation and the theoretical design frequency of proposed FDDPQO are independently

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	controllable through digital control bits of individual DCCDVCCs. Non-ideal behavior and sensitivity issues are also considered analytically. The proposed oscillator is simulated using circuit implemented in the TSMC 0.25m CMOS technology. The results of computer simulation agree closely with the theoretical predictions.
ME015 15:45-16:00	Experimental Identification and Characterization of Multirotor UAV Propulsion **Denis Kotarski**, Matija Krznar, Petar Piljek and Nikola Simunic Karlovac University of Applied Sciences, Mechanical Engineering Department, J.J. Strossmayera 9, Croatia Peti Brod, Zlatarska 14, Croatia University of Zagreb, Faculty of Mechanical Engineering and Naval Architecture, Ivana Lucica 5, Croatia Abstract. In this paper, an experimental procedure for the identification and characterization of multirotor Unmanned Aerial Vehicle (UAV) propulsion is presented. Propulsion configuration needs to be defined precisely in order to achieve required flight performance. Based on the accurate dynamic model and empirical measurements of multirotor propulsion physical parameters, it is possible to design diverse configurations with different characteristics for various purposes. As a case study, we investigated design considerations for a micro indoor multirotor which is suitable for control algorithm implementation in structured environment. It consists of open source autopilot, sensors for indoor flight, “take off the shelf” propulsion components and frame. The series of experiments were conducted to show the process of parameters identification and the procedure for analysis and propulsion characterization. Additionally, we explore battery performance in terms of mass and specific energy. Experimental results show identified and estimated propulsion parameters through which blade element theory is verified.

Coffee Break <16:00---16:15>

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Session II

Measurement system and Electrical automation

Time: **16:15-18:30**

Location: Gallery

Chair: Prof. Mohamed SBIHI, Département Maintenance Industrielle Ecole Supérieure de Technologie de Salé, Université Mohammed V

ME003 16:15-16:30	A field-programmable gate array based control system for high-speed atomic force microscope force measurement **Hsien-Shun Liao** Department of Mechanical Engineering, National Taiwan University, Taipei 10617, Taiwan Abstract. Atomic force microscopy (AFM) has been widely used for measuring surface morphology at nanoscale. Besides, its unique ability of force measurement is able to provide new insights in bio-medical research, which complements the common optical image. However, to get a force image of a whole surface, the force measurement requires the AFM probe to press the sample surface at every pixel in the image. Therefore, the image resolution is usually reduced to increase the imaging rate. Even so, the force measurement in the common AFM still takes tens of minutes to capture one frame of image. This slow imaging process limits its possibility to observe dynamic phenomena of many bio-samples. To realize a highspeed force measurement system, the resonant frequencies of the mechanical components and the bandwidth of the control system need to be improved. In this work, the force measurement function was accomplished by a field-programmable gate array (FPGA) based controller. The experimental results shows that the system is able to achieve high-speed force measurement and capture one frame of force image in one minute.
ME006 16:30-16:45	WAMS measurements pre-processing for detecting low-frequency oscillations in power systems **P Y Kovalenko** Automated Electrical Systems Department, Ural Federal University named after the first President of Russia B.N. Yeltsin. 19 Mira st., Yekaterinburg, Russia Abstract. Processing the data received from measurement systems implies the situation when one or more registered values stand apart from the sample collection. These values are referred to as “outliers”. The processing results may be influenced significantly by the presence of those in the data sample under consideration. In order to ensure the

	accuracy of low-frequency oscillations detection in power systems the corresponding algorithm has been developed for the outliers detection and elimination. The algorithm is based on the concept of the irregular component of measurement signal. This component comprises measurement errors and is assumed to be Gauss-distributed random. The median filtering is employed to detect the values lying outside the range of the normally distributed measurement error on the basis of a criterion. The algorithm has been validated involving simulated signals and WAMS data as well.
ME007 16:45-17:00	Defining the parameters of a power transmission line equivalent circuit on the basis of phasor measurements **P Y Kovalenkoa** and A S Berdin Automated Electrical Systems Department, Ural Federal University named after the first President of Russia B.N. Yeltsin. 19 Mira st., Yekaterinburg, Russia Abstract. Power system control is based on employing its computational model, the backbone of which is an equivalent circuit. The equivalent circuit is involved in solving the problems of steady-state computation and analysis, state estimation, transient analysis etc. Its elements parameters are generally defined by the corresponding equipment reference data or datasheets. Although considered to be constant, these parameters depend upon the element actual load, weather conditions and other factors. Consequently, the results of the outlined problems may be subject to significant bias due to the difference between the reference and the actual elements parameters. Hence the task of identifying the actual equivalent circuit parameters is of paramount importance. In terms of power system control the actual measurements are to be used in order to provide the relevant information on the considered power system component state. As for the transmission lines, the state measurements must include the currents and voltages at both ends of the line regarding the П-shaped equivalent circuit. That said, at present time the equivalent circuit parameters might be defined involving modern systems of phasor measurements (WAMS) on a real-time basis. The method of defining the equivalent circuit parameters based on phasor measurements along with general relations between power system state parameters is proposed. It should be noted as well that while dealing with the actual WAMS data obtained from power system the measurement errors influence the results quite substantially.
ME008 17:00-17:15	Comparing the techniques of defining the synchronous machine load angle **P Y Kovalenko** and A N Moiseichenkov Automated Electrical Systems Department, Ural Federal University named after the first President of Russia B.N. Yeltsin. 19 Mira st., Yekaterinburg, Russia Electrical Machines Department, Ural Federal University named after the first President

	of Russia B.N. Yeltsin. 19 Mira st., Yekaterinburg, Russia Abstract. The low-frequency oscillations are natural for power systems and may arise due to both small variations of load and large disturbance. The effect of slight load changes may significantly differ for cases of low-magnitude permanent oscillations, which may be considered acceptable, and unstable oscillations, which may lead to a major system emergency. The existing trend of increasing the capacity of long-range power transmission has led to the situation where inter-area oscillations may appear underdamped or even rising in terms of magnitude. Effective oscillations detection with the corresponding countermeasures along with eliminating the prerequisites leading to the oscillations is a guarantee of minimizing their negative consequences. Therefore, it is of crucial importance to perform continuous monitoring which is to provide the information on the "source" of oscillations – a generator or a group of generators, which do not contribute to the oscillations damping or even support their development. The algorithm of quantitative estimation of synchronous generators participation in low-frequency oscillations damping based on synchronized phasor measurements has been proposed previously. It implies utilizing the concept of synchronizing power as a measure of the capability of the machine to maintain synchronous operation. The load angle of the generator is necessary to define the value of the synchronizing power and since the direct measurement of the load angle is generally not available the techniques of its derivation have been developed. The comparison of these techniques is presented with the estimation of the adopted assumptions effect on the synchronizing power evaluation results.
ME010 17:15-17:30	Influence of measurement levels number on the accuracy of calculated estimate during the electrical energy measurements verification **E S Kochneva** and A Sukalo Automated Electrical Systems Department, Ural Federal University named after the first President of Russia B.N. Yeltsin, 19, Mira str, Yekaterinburg, Russia Elektroperenos – Elektroprijenos BiH, Banja Luka, Bosna and Hercegovina Abstract.-Verification of electric energy measurement is a very important issue. The research deals with the modified method of testing equations, which enables measurement-based electrical energy estimation of higher accuracy compared to the initial measurements. The influence of the testing equations number on the estimation error value is investigated. Test results are presented for 14-node IEEE scheme. The necessity of using the limited measurement level number is proved.
ME011 17:30-17:45	Testing equations method for electrical energy measurements systematic errors detection and measurements results adjustment **E S Kochneva**, A V Pazderin and A Sukalo

ABSTRACTS

	Automated Electrical Systems Department, Ural Federal University named after the first President of Russia B.N. Yeltsin, 19, Mira str, Yekaterinburg, Russia Elektroperenos – Elektroprijenos BiH, Banja Luka, Bosna and Hercegovina Abstract. State estimation theory is widely used for telemetry verification. Similar approaches can successfully be applied to electric energy measurements. Testing equations method was proposed in the frameworks of the state estimation theory and adopted for bad energy measurements detection. It is proposed to employ the modified testing equations method for detecting the systematic measurements errors of automatic electrical energy meter reading complexes. It is shown and confirmed that provided the statistical sample it is possible to detect and evaluate the systematic error, which, in turn, allows taking this error into account and adjusting the measurements results.
ME030 17:45-18:00	A method of reconstructing the spatial measurement network by mobile measurement transmitter for shipbuilding Siyang Guo, Jiarui Lin, Linghui Yang,Yongjie Ren and Yin Guo State Key Laboratory of Precision Measuring Technology and Instruments, Tianjin University, Tianjin, 300072, China Abstract. The workshop Measurement Position System (wMPS) is a distributed measurement system which is suitable for the large-scale metrology. However, there are some inevitable measurement problems in the shipbuilding industry, such as the restriction by obstacles and limited measurement range. To deal with these factors, this paper presents a method of reconstructing the spatial measurement network by mobile transmitter. A high-precision coordinate control network with more than six target points is established. The mobile measuring transmitter can be added into the measurement network using this coordinate control network with the spatial resection method. This method reconstructs the measurement network and broadens the measurement scope efficiently. To verify this method, two comparison experiments are designed with the laser tracker as the reference. The results demonstrate that the accuracy of point-to-point length is better than 0.4mm and the accuracy of coordinate measurement is better than 0.6mm.
ME031 18:00-18:15	Distance measurement using frequency scanning interferometer combined with a femtosecond pulse laser Yang Liu, Yue Shang, Linghui Yang, Jiarui Lin, Shibin Yin and Jigui Zhu Tianjin University, China Abstract-Precise distance measurement is of interest for large-scale manufacturing, future space satellite missions, and other industrial applications. The ranging system with

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	femtosecond optical frequency comb (FOFC) could offer high accuracy, stability and direct traceability to SI definition of the meter. Here, we propose a frequency scanning interferometer (FSI) using a wavelength tunable laser with a reference interferometer using a femtosecond pulse laser. The reference arm of FSI is calibrated by the intensity detection using the FOFC within an optical wavelength resolution. With analysis of the theoretical model, this system could achieve a high-speed, high-accuracy and arbitrary absolute distance measurement. In addition, the performance of this system is evaluated by a single position measurement with different tuning velocities of wavelength. The experimental results show that the reproducibility of the distance measurement is 10e-5 level.
ME033 18:15-18:30	DMI measurements impact on a position estimation with lack of GNSS signals during Mobile Mapping K Bobkowka , G Nykiel, P Tysiąc Department of Geodesy, Faculty of Civil and Environmental Engineering, Gdansk University of Technology, Gabriela Narutowicza str. 11/12, 80-233 Gdansk, Poland Abstract. Nowadays, Mobile Laser Scanning is common in use in addition to geodesy measurements. The data which are provided by the system characterizes with high precision and flexibility. To precise mapping, the accuracy of the data should be maintained. In Poland, according to the minister's dispositions, the accuracy of the data should not exceeded 10 cm. With fully operated system it is easy to uphold, but there is a situation when a signal from an INS is not enough to preserve it. This paper is presenting the solution of a DMI use in Mobile Laser Scanning measurements as the support for position estimation during lack of satellites signal situation when the vehicle with the platform was entered the tunnel. To comparison the results a several of entrances was performed. This research helps understand the use of DMI in mobile data acquisition in different acquiring situations.

Dinner <18:30-20:00> Location: Atrium

Notebook