Conference Program
IEEE - PEMC 2018

2018 IEEE International Conference on Power Electronics and Motion Control (PEMC)

Novotel Budapest City and Budapest Congress Center
Budapest, Hungary
26-30 August, 2018

Sponsored by
The Institute of Electrical and Electronics Engineers (IEEE)
IEEE Industrial Electronics Society (IES)
IEEE Industry Applications Society (IAS)

General Information

VENUE

The venue of the conference is Novotel Budapest City and Budapest Congress Center (1-3 Jagelló Str., 1123 Budapest, Hungary, www.bcc.hu)

REGISTRATION DESK

The registration desk will be open during the whole event.

PRESENTATIONS

Each oral presentation (except key-notes) will have 2 minutes for speaker introduction 13 minutes for presentation and 5 minutes for questions and answers.

All presentation should be done on the computer available in the room. The presentations should be uploaded during the breaks (coffee, lunch) prior the session. A student assistant will help speakers in each room.

POSTERS

The posters can be set up anytime from 8:00 AM on the day of the presentation until 15 minutes before the poster session. The posters can be left throughout the day of presentation but must be removed before 7:30 PM.

SOCIAL PROGRAMS

Sunday 26th of August 18:30 – 20:30 - "Aula" - Welcome Cocktail – included in the registration fee
Tuesday 28th of August 18:00 – 22:00 - Lázár Equestrian Park – Gala Dinner and horse show – included in the registration fee.
Extra tickets can be purchased at the registration desk for 70 EUR until 14:00, Monday, August 27.
Bus departure 17:00 – entrance of Novotel Budapest City Hotel.
Thursday 30th of August 8:30 – 19:00 - Post Conference Tour to the Lake Balaton – optional, price 90 EUR/person
The program includes the transfer by an air-conditioned bus, guided tours in the Herend Porcelain Manufactory, at the Tihany Benedictine Abbey and in Balatonfüred as well as a 3-course lunch in a traditional Hungarian restaurant with wine tasting.
Meeting Point: Novotel Budapest City Hotel
Tickets can be purchased at the registration desk until 14:00, Monday, August 27.
The program is subject of minimum 20 participants.

EMERGENCY PHONE NUMBERS

Ambulance: 104
Fire service: 105
Police: 107
Should any participant need help during the event, call Monika Jetzin at 00 36 20 985 6424.

INSURANCE

The Organizers of the Conference do not provide insurance and do not take responsibility for any loss, accident or illness that might occur during the Conference or in the course of travel to or from the meeting site. It is, therefore, the responsibility of the participants to check their coverage with their insurance provider.

BANK, CURRENCY, CREDIT CARDS

The Forint (HUF), the official national currency, is convertible. The exchange rates applied in banks, official exchange offices and hotels may vary. All the major credit cards are accepted in Hungary in places displaying the emblem at the entrance. Exchange rate: 1 Euro = 323 HUF in July 2018.

VOLTAGE

The electricity supply in Hungary is 230 V AC (50 Hz).

TAXI

In order to avoid any inconveniences, please use the official taxi companies:

- City Taxi, phone: +36 1 2 111 111
www.citytaxi.hu
- Főtaxi, phone: +36 1 222 2 222
www.fotaxi.hu

Credit card payment is available in every car. Please note,that all licensed Budapest taxi companies have yellow cars and same rates for all companies, placed clearly visible on the screens.

TIME ZONE

CET=GMT+1

Sunday 26th of August

TU - Development of Power Converters and Control for electrical Drives

Plenary Room, Sunday 26th of August, 14:00
Lecturer/s: Vladimir Blasko, IEEE Felow

The tutorial will give the historic overview of the development of 3+phase power converters and present state of art of Si based power converters in industrial drives. The most common converter architectures (standard non-regenerative, regenerative with common dc link, matrix converter, current source, multi-level) will be introduces and compared. Comparative analysis will show the advantages and gaps of particular topologies.
The figure of merits and metrics for power converters for industrial and aerospace applications will be discussed leading to the role and place of Wide Band Gap (SiC and GaN) device technology in the future development of power converters.
Power structure converter analysis will be followed by the challenges in the control aspect of the drive/converter development.
Control part will encompass practical hardware considerations including microprocessor selection, current feedback issues related to offset and bias, sampling rate, tuning process and achievable bandwidth of the drives.

Vladimir Blasko holds the position of a Senior Fellow at United Technologies Research Center, USA. Previously he worked for Otis Elevator Company, Rockwell Automation-Allen Bradley Company and Research Institute of Koncar Company-Zagreb, Croatia.
Dr. Blasko has published more than 40 papers and holds more than 40 patents. He is IEEE Fellow, Adjunct Professor at the University of Wisconsin-Madison and Adjunct Professor of Electrical Engineering at the University of Zagreb, Croatia, and a member of Connecticut Academy of Science and Engineering. His primary areas of research interest are power electronics, modern AC drives, distributed energy stems, intelligent power management, and applied modern control theory and technology.

TU - Time Domain Power Quality Evaluation

Oral Sessions Room 2, Sunday 26th of August, 14:00
Lecturer/s: Alex Ruderman, IEEE Senior Member

The Tutorial addresses voltage and current Total Harmonic Distortion (THD) calculation for grid-tied inverters with both high frequency PWM and low frequency synchronous switching. On theoretical side, THD is historically being analyzed in frequency domain probably due to its frequency domain definition.
The author systematically develops voltage and current THD time domain evaluation approach. Such analysis is based on Parseval theorem (Rayleigh energy equality) and requires calculation of voltage and current waveform mean squares.
For PWM, this approach originates from the 1988 paper by Prof. H.W. van der Broeck; for synchronous optimal modulation, it was first independently suggested in 1977 papers by Profs. S. Halasz and G. Buja.
For PWM inverters, the analysis uses a realistic asymptotic assumption - large apparent switching-to-fundamental frequencies ratio. For voltage THD, simple closed-form formulas are obtained for single- and three-phase multilevel inverters; for current THD - for single-phase multilevel voltage source inverters with inductance dominated RL-load and in the presence of LCL-filter and for current source inverters with CL-filters.
Most recent contribution includes current THD optimization for cascade H-bridge inverter with 4 and more bridges for phase shifted PWM by non-equal DC sources switching sequence (carrier order) selection. This is relevant for distributed generation.
For low frequency synchronous modulation, minimal THD problems are formulated in time domain as constrained optimization ones. The natural generalisations include: combined minimal THD and Selected Harmonic Elimination (SHE) problem formulation that some degrees of freedom are spent on SHE while the rest – on THD minimization; combined minimal THD and Selected Harmonic Mitigation to meet international standards (TDD) with a minimum coupling inductor.
Each subtopic is illustrated by an in-depth analysis of simple representative demo cases.
The presentation is self-explanatory intended for an entry/intermediate level audience.

Alex Ruderman (M'07, SM'17) was born in Leningrad, USSR, in 1957. He received his M.Sc. degree with Honors from Leningrad Electrical Engineering Institute (1980) and Ph.D. degree from Leningrad Polytechnic Institute (1987) (in electrical and electromechanical engineering, respectively).
In 1995-2003, Alex worked for Intel Corporation Microprocessor Development Center (Haifa, Israel) as a research scientist investigating into microprocessors thermal stabilization, fast static timing calculations including cross-talk, power delivery and power minimization related issues.
In 2006, he joined Elmo Motion Control, Petach Tikva, Israel, the makers of compact intelligent servo drives, as Chief Scientist (Elmo drives are allegedly used by NASA in Mars Curiosity mission).
Since 2013, Alex is Associate Professor at Nazarbayev University School of Engineering, Electrical and Electronic Engineering Department. He is a Director of Power Electronics Research Laboratory (PERL).
Alex is a regular reviewer for IEEE Transactions on Industrial Electronics and Power Electronics and a program / advisory / scientific committee member for several international Power Electronics Conferences. His major research focus is on simple time domain methods applied to analysis of multilevel inverters he authored more than 50 conference and journal papers on the subject.
Alex was a member of IEEE Power Electronics Technical Committee (PETC) (2010-2013) and since 2013 he is Associate Editor for the IET Journal of Power Electronics.

Monday 27th of August

Opening ceremony

Plenary Room, Monday 27th of August, 08:30
Peter Korondy, General Chair IEEE-PEMC 2018
Pavol Bauer, Chair of the PEMC Council
Mihai Cernat, Program Chair IEEE-PEMC 2018

Keynote address Joeri Van Mierlo

Plenary Room, Monday 27th of August, 09:00
Keynote Addresser: Prof. Dr. Joeri Van Mierlo
Presenter: Prof. Dr. Teresa Orlowska-Kowalska, Poland

E-mobility Developments

Joeri Van Mierlo, Vrije Universiteit Brussels, Belgium

It is an exciting period of time, where the transition towards a more sustainable mobility via the introduction of electric vehicles is taking place. What are the benefits and barriers for the e-mobility developments? Driving range, charging infrastructure availability and especially cost are perceived as important barriers for the market take-up of electric vehicles. Driving range is defined by o.a. battery performance. The challenge of infrastructure lies in the return on investment (chicken and egg problem). And the cost will evolve by technological improvement, market take-up and in the mean time policy support.
The purchase price of electric vehicles is currently higher than of conventional vehicles, however the driving cost is lower. Based on a Total Cost of ownership (TCO) different vehicle technologies can be compared. Results are strongly depending on the market segment assessed as well as on the incentives put forward by the legislation.
How to compare the environmental performance of different vehicle technologies? Vehicles with lower tailpipe emissions are perceived as cleaner. However, does it make sense to look only to tailpipe emissions? Limiting the comparison only to these emissions denies the fact that there are emissions involved during the production of a fuel. Would it be enough to combine fuel production and tailpipe emissions? Especially when comparing the environmental performance of electric vehicle technologies, the emissions during production of the specific components and their appropriate end-of-life treatment processes should also be taken into account. Therefore, the complete life cycle (LCA) of the vehicle should be included in order to avoid problem shifting from one life stage to another.

Joeri Van Mierlo is a key player in the Electromobility scene. He is professor at the Vrije Universiteit Brussels, one of the top universities in this field.
Prof. Dr. ir. Joeri Van Mierlo leads the MOBI – Mobility, Logistics and automotive technology research centre (http://mobi.vub.ac.be). A multidisciplinary and growing team of 100 staff members. Prof. Van Mierlo was visiting professor at Chalmers University of Technology, Sweden (2012).
He is expert in the field of Electric and Hybrid vehicles (batteries, power converters, energy management simulations) as well as to the environmental and economical comparison of vehicles with different drive trains and fuels (LCA, TCO).
Prof. Van Mierlo is Vice-president of AVERE (www.avere.org), the European Electric Vehicle Association and Vice-president of its Belgian section ASBE (www.asbe.be). He chairs the EPE chapter “Hybrid and electric vehicles” (www.epe-association.org). He is an active member of EARPA (European Automotive Research Partner Association) and member of EGVIA (European Green Vehicle Initiative Association). He is director of Flanders Make department "Power electronics, actuators and energy storage".
He is IEEE Senior Member and member of IEEE Power Electronics Society (PELS), IEEE Vehicular Technology Society (VTS) en IEEE Transportation Electrification Community.
He is the author of more than 500 scientific publications. He is editor in chief of the World Electric Vehicle Journal and co-editor of the Journal of Asian Electric Vehicles and member of the editorial board of “Studies in Science and Technology”, "Batteries" as well as of “ISRN Automotive Engineering”. He is Guest Editor of Special Issues "Rechargeable Battery Technologies--From Materials to Applications" of "Batteries" as well of "Advances in Plug-in Hybrid Vehicles and Hybrid Vehicles" of the "Energies" Journal.

Keynote address Pavol Bauer

Plenary Room, Monday 27th of August, 09:30
Keynote Addresser: Prof. Dr. Pavol Bauer, IEEE Senior Member
Presenter: Prof. Dr. Jaeho Choi, Korea (South)

Electric vehicles – key to energy transition

Pavol Bauer, Delft University of Technology

Charging infrastructure for electric vehicles (EV) will be the key factor for ensuring a smooth transition to e-mobility. This keynote focusses on five technologies that will play a key role in this regard: smart charging, vehicle-to-grid (V2G), charging of EVs from photovoltaic panels (PV), contactless charging and on-road charging of EVs. Smart charging of EVs which will enable larger penetration of EVs and renewable energy, lower the charging cost and offer better utilization of the grid infrastructure. Bidirectional EV chargers will pave way for V2G technology where the EV can be used for energy arbitrage and demand side management. Solar charging of EV will result in sustainable transportation and use of the EV battery as PV storage. On the other hand, stationary contactless charging and on-road inductive charging of EV will remove the necessity for any cables, eliminate range anxiety issues and pave way for automated driving. Fast charging and multiplexing will be addressed too.

Pavol Bauer is currently a full Professor with the Department of Electrical Sustainable Energy 0f Delft University of Technology and head of DC Systems, Energy Conversion and Storage group. He received Masters in Electrical Engineering at the Technical University of Kosice (‘85), Ph.D. from Delft University of Technology (’95) and title prof. from the president of Czech Republic at the Brno University of Technology (2008) and Delft University of Technology (2016). From 2002 to 2003 he was working partially at KEMA (DNV GL, Arnhem) on different projects related to power electronics applications in power systems. He published over 90 journal and over 300 conference papers in his field (with H factor Google scholar 35, Web of science 24), he is an author or co-author of 8 books, holds 6 international patents and organized several tutorials at the international conferences. He has worked on many projects for industry concerning wind and wave energy, power electronic applications for power systems such as Smarttrafo; HVDC systems, projects for smart cities such as PV charging of electric vehicles, PV and storage integration, contactless charging; and he participated in several Leonardo da Vinci and H2020 EU projects as project partner (ELINA, INETELE, E-Pragmatic) and coordinator (PEMCWebLab.com-Edipe, SustEner, Eranet DCMICRO). He is a Senior Member of the IEEE (’97), former chairman of Benelux IEEE Joint Industry Applications Society, Power Electronics and Power Engineering Society chapter, chairman of the Power Electronics and Motion Control (PEMC) council, member of the Executive Committee of European Power Electronics Association (EPE) and also member of international steering committee at numerous conferences.

Keynote address H. Bülent Ertan

Plenary Room, Monday 27th of August, 10:00
Keynote Addresser: Prof. Dr. H. Bülent Ertan, IEEE Member
Presenter: Ivan Petrović, Croatia

Design and Comparison a High Power Density Magnetically Geared PM Generator Topology with a Radial Flux PM Generator

H. Bülent Ertan, Atılım University, Ankara, Turkey
Reza Zeinali, Eindhoven University, Eindhoven Holland

Direct drive generator arrangement for wind energy conversion promises higher energy yield and higher efficiency than geared wind energy conversion systems. In this paper an electrical machine topology called Dual Stator Spoke-Array Vernier Permanent-Magnet machine" is evaluated as a magnetically geared direct drive generator. This is because, this topology is known to facilitate reaching higher fundamental flux density in the air gap in comparison with other Vernier type machines and is known to reach higher power factor values. For this evaluation a hybrid analytic - numerical design method is developed which is suitable for use in mathematical design optimization. This design method is used in identifying the optimum designs for magnetic gear ratios of 5, 11 and 17. These optimal designs are compared with optimized radial flux PM generators designed for the same specifications. The findings indicate that it is possible to reduce the weight of a 50 kW input, direct
- drive generator running around 60 rpm by about 50% compared to RFPM generator, while keeping the generator and converter cost at the same levels.

H. Bülent Ertan (Huluşi Bülent Ertan) received B.S. and M.S. degrees in Electrical and Electronics Engineering (EEE) in 1971 and 1973 respectively from Middle East Technical University (METU) in Ankara, Turkey and Ph.D. degree from the University of Leeds, UK in 1977. He is currently a Professor in EEE Department of Atilim University.
He directed many industry supported projects since 1977. He led the Intelligent Energy Conversion Group at TUBITAK (Turkish Scientific and Technological Research Council) Information Technologies and Electronics Research Institute (BILTEN) in Ankara Turkey, between 1999-2006. He is currently executive committee member of Center for Wind Energy, METU and also director of the Electromechanics laboratory. Prof. Ertan was chairman of the Mustafa Parlar Education and Research Foundation in 2000 and he was a member of the executive board of this foundation until 2016.
He has published more than 150 journal and conference papers so far. He is co-editor of two books entitled "Modern Electrical Derives", Kluwer Academic Publishers, Netherlands, 2000 (NATO ASI series) and "Transformers: Analysis Design and Measurement" (CRC press, 2013). Prof. Ertan is holder of 5 national and international patents. He received the IEE Overseas Premium award in 1993 and an IEEE award in 2014, for his contributions to the IEEE standard "Trial-use guide for testing permanet magnet machines".
Professor Ertan is founder of the Aegean International Conference on Electrical Machines and Power Electronics (ACEMP). His research interests are on electrical machine design and drive systems and wind energy conversion.
His current interests are wind energy conversion, traction motor design, hybrid electrical vehicle design and in general design of electrical motors and drives. He is a member of Turkish Chamber of Electrical Engineers and member of IET (UK) and IEEE.

Reza Zeinali was born in Iran. He received the B.Sc. degree in electrical engineering from Amirkabir University of Technology, Tehran, Iran in 2013. He Obtained M.Sc. degree in electrical engineering from Middle East Technical University, Ankara, Turkey. Currently he is working toward the Ph.D. degree in Eindhoven University of Technology, the Netherlands. His research interests include design and analysis of electrical machine and Iron loss modeling.

Poster Session PS1-TT01

Aula - Monday 27th of August, 11:00
Chairs: Masatoshi Uno, Japan, Sevilay Cetin, Turkey

SCC Equivalent Resistance: the Relationship for Complementary Buck and Boost and Accurate Calculation for 2-Phase Converters

Yerzhan Mustafa, Ainur Zhaikhan, Alex Ruderman

A Direct Matrix Converter with Space Vector Modulation for Contactless Energy Transfer Systems

Jannis Noeren, Nejila Parspour, Benjamin Sekulic

Design Optimization of High-Frequency WBG-Based LLC Resonant Converter for Telecom Applications

Siamak Karimi, Farzad Tahami

Transient and Steady-State Analysis of a SEPIC Converter by an Average State-Space Modelling

Tomer Polsky, Yoram Horen, Svetlana Bronshtein, Dmitry Baimel

A Novel Power Electronics for Contactless Inductive Energy Transfer Systems

David Maier, Jannis Noeren, Nejila Parspour, Christopher Lauer

Programmable Power Electronics Voltage Source with Sigma-Delta Modulator in Control Section

Michal Gwozdz, Dominik Matecki

Soft-Switching Converter Based on Primary Series Connection and Single Transformer

Bor-Ren Lin, Yong-Sheng Zhuang

The Optimal Composition of Diesel Particulate Filter Using Induction Heating

Sachio Kubota

3-phase Diode Rectifier with Current Modulation in DC Circuit

Michal Gwozdz, Michal Krystkowiak, Lukasz Cieplinski

Poster Session PS1-TT02

Aula - Monday 27th of August, 11:30
Chairs: Piotr Serkies, Poland, Stefan Brock, Poland

Numerical and Experimental Study on the Cooling Performance Affected by ventilation holes of a BLDC Motor for Multi-copters.

Sungjin Yang, Yunju Jung, Jungmoo Seo, Joo-Han Kim, Myungsung Lee

Controller Design of a New Universal Two-Phase SiC-GaN-Based DC-DC Converter for Plug-In Electric Vehicles

Milad Moradpour, Gianluca Gatto

DC-DC Buck Converter Parameter Identification Based on a White-Box Approach

Hariharan Balakrishnan, Manuel Moreno-Eguilaz, Jordi-Roger Riba, Santiago Bogarra, Antoni Garcia

Starter-Generator System for Gas Turbine Engine Based on AC-AC Converter

Maksim Zharkov, Vadim Sidorov, Sergey Kharitonov

Wheel Slip Determination Capability of Locomotive Driven by Model Predictive Control

Pavel Karlovsky, Jan Bauer

Modeling and analysis of EMI and overvoltage phenomenon in SiC inverter driven motor at high switching frequency

Duc Hoan Tran

Multi-objective optimization design of electric vehicle converters based on ε-γ-σ

Xu Luo, Xuemei Wang, Haiping Wu

Novel Design Approach of Wireless Chargers for Electric Vehicles

Lucian MandacheAndrei Marinescu, Ionel Dumbrava

Charging process control of dynamic wireless power transfer system with active rectifier and without wireless communication system

Mojtaba Khalilian

Poster Session PS1-TT04

Aula - Monday 27th of August, 12:00
Chairs: Dong-Hee Lee, Korea (South), Ibrahim Sefa, Turkey

A Soft-Switching Single-Phase Two-Arm Dynamic Voltage Restorer

Maoh-Chin Jiang, Tai-Chun Liu

Similarities between Virtual Oscillator Controlled and Droop Controlled Three-Phase Inverters

Zhan Shi, Hendra I. Nurdin, John E. Fletcher, Jiacheng Li

Design of All-Sinusoidal Single Phase On-Line UPS with AVR for Improving Sinusoidal Output Voltage

Ghazanfar Shahgholian, Ahmad Omrani, Jawad Faiz

Droop Control Strategy with a Novel Characteristic Model

Kiryong Kim, Jong-Pil Lee, Tae-Jin Kim, Ju-Won Baek, Hee-Je Kim

Energy Management Strategy for Supercapacitor Storage using a Nonlinear Virtual Impedance

Dan-Cornel Hulea, Octavian Cornea, Nicolae Muntean

Synchronous Buck-Boost Converter for Energy Harvesting Application

Benjamin Oslaj, Primoz Slibar, Mitja Truntic, Miro Milanovic

Analysis of Load Regulation for Series and Parallel Output Inverters

Zhilei Yao, Jing Xu, Simin Peng

Poster Session PS1-TT06

Aula - Monday 27th of August, 12:30
Chairs: Mehmet Dal, Turkey, Gabriel Khoury, Lebanon

A new technique to identify induction machine rotor parameters during dynamic operation and low speed

Walter Fahrner, Markus Vogelsberger, Thomas Wolbank

An Electrohydraulic Actuation Scheme Using Novel Piezoelectrically-Actuated Nozzle Flapper Valve

Yihao Du, Bin Wang

Analysis and Design of Spoke-type Ferrite Permanent Magnet Motor with Rotor Overhang

Jungmoo Seo, Ahreum Ro

Power HIL Emulation of AC Machines with Parallel Connected ANPC Bridge Arms

Zoltan Suto, Attila Balogh, David Kiss, Szabolcs Vereb, Istvan Varjasi

Modeling and Analysis of a New Voltage Regulation Method for Surface-Mounted Permanent Magnet Synchronous Generator

Wang Yongjie, Wang Huizhen, Liu Weifeng, Wang Qin

Development and Simulation of the Series Elastic Actuator for force sensing

Haneul Yun, Jinuk Bang, Jihyeon Kim, Jangmyung Lee

TT01 - Converter Topologies 1

Plenary Room, Monday 27th of August, 14:00
Chairs: Bor-Ren Lin, Taiwan, Michal Gwozdz, Poland

Performance of a Two-Stage Actively Damped LC Filter for GaN/SiC Motor Inverters

Franz Maislinger, Hans Ertl, Laura Siplika, Goran Stojcic

On Current THD Extreme Switching Sequences for a Single-Phase Cascade H-Bridge Inverter with Phase-Shifted PWM and Non-Equal DC Sources

Ruslan Polichshuk, Nurzhan Zhuldassov, Alex Ruderman, Boris Reznikov

Highly-extendable capacitive current balancing multi-channel LED driver with reduced capacitor count

Yoshiya Tada, Yusuke Sato, Masatoshi Uno

Direct Cell-to-Cell Voltage Equalizer Using Capacitively-Isolated Parallel-Resonant Converter for Series-Connected Energy Storage Cells

Koji Yoshino, Koki Hasegawa, Masatoshi Uno

A Novel Hybrid Step-Down DC-DC Converter

Ioana-Monica Pop-Calimanu, Septimiu Lica, Dan Lascu, Folker Renken, Mircea Gurbina, Radu Mirsu

Modified SEPIC DC-to-DC Converter (2/1-k) Output Gain Configuration for Renewable Power Energy and High Voltage Applications

Emre Ozsoy, Sanjeevikumar Padmanaban, Viliam Fedak, Charles Muranda

TT02 - Transportation

Oral Sessions Room 1, Monday 27th of August, 14:00
Chairs: Duc Huan Tran, France, Lucian Mandache, Romania

Multiphase DC/DC Converter and its Use in the Powertrain of Fuel Cell Vehicles

Folker Renken, Wensong Shen, Udo Schürmann, Ioana-Monica Pop-Calimanu

Parallel Operation Dual-Output Inverters with PR Control for Railway Signal Power Systems

Rui Zhao, Jianxin Zhu, Fan Wu, Xun Gao, Yan Xing, Li Zhang, Xudong Ma

Method for Torsional Vibrations Detection of Locomotive Wheelset Based on UKF

Petr Pichlík

Application Dependent Optimization of Balancing Methods for Lithium-ion Batteries

Szabolcs Vereb, Gergely G. Balazs, Tamas Kokenyesi, Tibor Debreceni, Zoltan Suto, Istvan Varjasi

Determining Relation between Size of Polarized Inductive Couplers and Nominal Air gap

Soumya Bandyopadhyay, Pavol Bauer, Laura Ramirez-Elizondo, Jianning Dong

Maximum Torque Per Ampere based Direct Torque Control scheme of IM drive for Electrical Vehicle Applications

Pratibha Naganathan, Srirama Srinivas

TT06 - Electrical Machines 1

Oral Sessions Room 2, Monday 27th of August, 14:00
Chairs: Ilhami Colak, Turkey, Emanuel Castagnaro, Italy

Design of Dual Rotor Axial Flux Permanent Magnet Generators with Ferrite and Rare-Earth Magnets

Tohid Asefi, Jawad Faiz, Azeem Khan

Regenerative Testing of Multiphase Machines with Multiple Three-phase Windings

Mikel Zabaleta, Emil Levi, Martin Jones

Feedforward Finite Control Set Model Predictive Position Control of PMSM

Karol Kyslan, Viktor Slapak, Frantisek Durovsky, Viliam Fedak, Sanjeevikumar Padmanaban

An STFT-MLA combination used in induction motor's rotor faults diagnosis at variable speed

Ameur-Fethi Aimer, Mohammed-El-Amine Khodja, Ahmed-Hamida Boudinar, Noureddine Benouzza

Torque Ripple Minimization in Double U Core Switched Reluctance Motor

Mustafa Aydemir, Halil-Ibrahim Okumus, Merve Aydin

Influence of Poles Embrace on In-wheel Switched Reluctance Motor Design

Merve Yildirim, Hasan Kurum

TT01 - Converter Topologies 2

Plenary Room, Monday 27th of August, 16:30
Chairs: Ioana-Monica Pop-Calimanu, Romania, Farzad Tahami, Iran

High-Frequency Soft-Switching DC-DC Converter with Non-Dissipative Turn-Off Snubber

Marek Pastor, Jaroslav Dudrik, Milan Lacko

Analysis and Verification on CLLC Resonant Bidirectional DC-DC Converter based on Variable Frequency Phase Difference Control Principle

Yasutaka Koga, Tomokazu Mishima

Nonlinear MIMO control of interleaved three-port boost converter by means of state-feedback linearization

Ander Gonzalez, Tat Kei Chau, Ramon Lopez-Erauskin, Herbert Ho-Ching Iu, Fernando Tyrone, Johan Gyselinck

Determination Optimal Operation Region of LLC Resonant Converter for On-Board EV Battery Charger

Sevilay Cetin, Veli Yenil

A Novel Type of Wireless V2H with Single Switch Dual-Active Seamless Converter in a Smart House

Taichi Iwanaga, Hideki Omori, Tatsuya Takahashi, Masahito Tsuno, Toshimitsu Morizane, Noriyuki Kimura

A Multifunctional Integrated Onboard Battery Charger for Plug-in Electric Vehicles (PEVs)

Chinmaya K A, Girish Kumar Singh

TT04 - Electrical Energy 1

Oral Sessions Room 1, Monday 27th of August, 16:30
Chairs: Zhilei Yao, China, Dmitry Baimel, Israel

PV Source Inverter with Voltage Compensation for Weak Grid Based on UPQC Configuration

Desmon Petrus, Jaeho Choi

Techno-economic feasibility study on an off-grid renewable energy microgrid for an isolated greenhouse in Romania

Toma Patarau, Dorin Petreus, Radu Etz, Eniko Lazar

The Design and Analysis of a Two-Stage PV Converter with Quasi-Z Source Inverter

Ersan Kabalci

Excitation Controller for a Synchronous Generator with a DC Exciter

Dusan Joksimovic, Slavko Veinovic, Djordje Stojic

Power Conditioning Unit for Direct-Drive Wave Energy Converter

Konstantin Kryukov, Yuri Rozanov, Yuri Tserkovsky, Michael Kiselev, Michael Lepanov, Ekaterina Namestnikova

Comparison of Two-Phase Interleaved and Flyback Converters for Solar Micro Inverters

Aydin Boyar, Ersan Kabalci

TT06 - Electrical Machines 2

Oral Sessions Room 2, Monday 27th of August, 16:30
Chairs: Emil Levi, UK, Jawad Faiz, Iran

Analysis of the Operation of a Linear Generator for a Floating Wave Energy Converter

Ekaterina Kurbatova, Pavel Kurbatov, Oleg Molokanov

Synthetic Loading for Symmetrical and Asymmetrical Six-phase Machines

Ahmad A. Abduallah, Obrad Dordevic, Martin Jones

Sensorless Control of Wind Turbine Conversion Equipped With a DFIG Using MPPT Strategy

Houcine Becheri, Ismail. K. Bousserhane, A. Harrouz, Ilhami Colak, Korhan Kayisli

A Rapid Estimation of the Rotor Losses in High Speed Synchronous PM Machines

Emanuel Castagnaro, Grazia Berardi, Nicola Bianchi

Low Voltage Reluctance Synchronous Motor with New Reluctance Rotor for Water Pump

Pavol Rafajdus, Valeria Hrabovcova, Pavel Lehocky, Pavol Makys, Michal Kremen

Comparison of Inverter Topologies Suited for Integrated Modular Motor Drive Applications

Mesut Ugur, Hakan Sarac, Ozan Keysan

Tuesday 28th of August

Keynote address Vladimir Blasko

Plenary Room, Tuesday 28th of August, 08:30
Keynote Addresser: Dr. Vladimir Blasko, IEEE Felow
Presenter: Prof. Dr. Thomas Wolbank, Austria

Elimination, Tracking and Control of Variables with Periodic Waveforms in Power Electronics and Electrical Drives

Vladimir Blasko, United Technologies Research Center, East Hartford, CT, USA

A historic perspective, evolution and common theoretical framework for tracking and elimination of periodic disturbances/harmonics with arbitrary waveforms with focus on applications in electrical drives and power electronics is presented. Three different approaches from three different fields, namely from classical-general-control, electrical drives and adaptive noise canceling are analyzed.
The internal model principle, originating from control community, is introduced first as it provides a general and elegant solution for tracking and elimination of (a) DC type of signals (b) harmonic - sine and cosine signals and (c) repetitive - arbitrary periodic waveforms. After that, as a second approach, the synchronous reference frame current regulators are reviewed as broadly used and still dominant for current control in electrical drives. The synchronous regulators have difficulty to control distorted current having direct and inverse components. As a remedy, a combination of two separate synchronous regulators rotating in synchronous frames aligned with direct and inverse components is used. It is shown in the paper that after the transformation of integral parts of combined direct and inverse synchronous regulators into stationary reference frame, a single harmonic regulator in stationary reference is derived. Adaptive Noise Canceling (ANC) algorithm broadly used in digital signal and acoustic noise processing is reviewed as a third option and demonstrated for current control and selective harmonic elimination in grid tied inverters. It is shown that linear combiner and lest mean square (LMS) algorithm as parts of ANC have the same transfer function as a harmonic regulator and therefore can perform the same function.
High level of similarity and results between the approaches in three different fields (control, signal processing and power electronics) is shown and performances of different regulators are demonstrated through simulation. Experimental results from multiple applications are presented to demonstrate performances and capability.

Dr. Vladimir Blasko holds the position of a Senior Fellow at United Technologies Research Center, USA. Previously he worked for Otis Elevator Company, Rockwell Automation - Allen Bradley Company and Research Institute of Koncar Company - Zagreb, Croatia. Dr. Blasko has published more than 40 papers and holds more than 40 patents. He is IEEE Fellow, Adjunct Professor at the University of Wisconsin - Madison and Adjunct Professor of Electrical Engineering at the University of Zagreb - Croatia, and a member of Connecticut Academy of Science and Engineering. His primary areas of research interest are power electronics, modern AC drives, distributed energy stems, intelligent power management, and applied modern control theory and technology.

Keynote address Dana Kulić

Plenary Room, Wednesday 28th of August, 09:00
Keynote Addresser: Dr. Dana Kulić
Presenter: Claudio Melchiori, Italy

Estimating, Modeling and Predicting Human Motion

Dana Kulić, University of Waterloo, Canada

Improved understanding and modeling of human movement can be used to teach robots to perform tasks, allow robots to safely and intuitively interact with humans, and to provide assessment and appropriate assistance to restore and facilitate movement. In this talk, I will describe tools for human motion measurement and analysis suitable for on-line applications. In the first part of the talk, a method for on-line pose estimation that exploits the

geometry of the skeletal structure and motion space and can be applied to positional or inertial sensors will be described. In the second part of the talk, an inverse optimal control approach for motion modeling will be introduced. The proposed method creates a generative model of the motion that can be used for motion segmentation and prediction. Results on a variety of datasets, including experiments in rehabilitation settings, will illustrate the proposed methods.

Dana Kulić received the combined B.A.Sc. and M.Eng. degrees in electromechanical engineering, and the Ph.D. degree in mechanical engineering from the University of British Columbia, Canada, in 1998 and 2005, respectively. From 2006 to 2009, she was a JSPS Postdoctoral Fellow and a Project Assistant Professor at the Nakamura Laboratory at the University of Tokyo. She is currently an Associate Professor at the Electrical and Computer Engineering Department at the University of Waterloo, Canada. In 2014, she was awarded Ontario's Early Researcher award for her work on
rehabilitation and human-robot interaction. Her research interests include human motion analysis, robot learning, humanoid robots, and human-machine interaction.

Keynote address Jan Vittek

Plenary Room, Tuesday 28th of August, 09:30
Keynote Addresser: Prof. Dr. Jan Vittek, IEEE member
Presenter: Prof. Dr. Vladimir Katić, Serbia

Study of Energy Optimal and Near-optimal Control of a.c. Drives with Constant, Linear and Quadratic Frictions

Jan Vittek, Branislav Ftorek, Peter Butko
University of Zilina, Slovak Republic

Design and verification of two energy saving position control strategies for a.c. drives employing induction or permanent magnet synchronous motors including a study of their energy expenses and efficiency is the main contribution of this paper. It's supposed that load torque consists of combined constant, linear and quadratic components as a function of rotor speed. For evaluation of energy demands the energy optimal control strategy based on mechanical and electrical losses minimization is compared with the energy near-optimal one based on symmetrical trapezoidal speed-profile for pre-planned rest-to-rest position manoeuver. Both control strategies respect prescribed maneuver time and have defined acceleration profile to achieve the position set-point. Overall control system consisting of energy saving profile generator, pre-compensator and position control system respects principles of vector control and is capable of precise tracking of prescribed state-variables. Energy demands of both control strategies are verified and compared via simulations and preliminary experiments results of which confirmed possibility to achieve substantial energy savings.

Jan Vittek graduated from the Technical University of Transport Zilina, Slovakia in 1966. He received his Ph.D. degree from the same university in 1979. After two-years service in Czecho-Slovak Railroads he joined the Faculty of Electrical Engineering of the University of Transport and Communications, Zilina now University of Zilina in Zilina, Slovakia. In 1997 he became a Professor for 'Electric Traction and Electric Drives'. In the period 1998-2008 he was several times appointed to the position of Visiting Professor of the School of Computing and Technology, University of East London, UK as the reflection of long-term research co-operation. For the same period he was also a member of the 'International Association of Science and Technology for Development' (IASTED) committees on 'Control' and 'Energy and Power Systems'. His research interests include energy optimal and near-optimal control, control of electric drives and electric traction (including locomotive drives) and applied robust control techniques.

Branislav Ftorek received his Ph.D. degree from the University of Žilina in 2008. Currently he is head of Department of Applied Mathematics, Faculty of Mechanical Engineering, University of Žilina. His research interests are applied mathematics and the theory of special functions. The author can be contacted by e-mail branislav.ftorek@fstroj.uniza.sk and by phone +421 41 513 4962.

Peter Butko received his Ph.D. degree in power electrical engineering from Faculty of electrical engineering,

University of Zilina in 2017. His research interests are control of electric drives, position sensors sensitivity and control of servo systems. Currently he is with NXP Roznov, Czech Republic. The author can be contacted by e-mail, peter.butko@fel.uniza.sk.

Keynote address Mihoko Niitsuma

Plenary Room, Tuesday 28th of August, 10:00
Keynote Addresser: Mihoko Niitsuma
Presenter: Claudio Melchiori, Italy

Ethologically inspired robot behaviour in social environment

In the future robots might become part of our daily lives, for example in households and offices, in caring for elderly people, in developing the abilities of autistic children or in the rehabilitation of recovering patients. They can soon appear in our lives and homes. There have been multiple studies on the possible status of robots in society and most of these supposed that robots should be similar to humans both in appearance and in behavioural patterns. The presentation deals with the concept of the Hungarian-rooted ethorobotics, which opposite to the **above** trends apply ethology-based behavioural models. We should consider robots as a new artificial species that should not be similar to humans either in appearance or in behaviour. Robots should be robotlike and if we decide to use behavioural models then those should rather originate from animals. For example, dogs have integrated into human society so perfectly that some people consider them family members which ("who") faithfully serve their masters. This is exactly what we expect from robots. But when can we say that a porter robot was polite with us, or that an acting police robot was decided and professional?
These questions might seem remote, but we cannot wait with the solutions until the appearance of these robots as that way we could easily release uncontrolled monsters onto humanity. Along with the technical development of robots we have to continually deal with their social integration, as we start the education of a child in childhood and not when she/he's already grown up physically. This presentation focuses on the observation, modelling and IT implementation of basic behavioural patterns.

Mihoko Niitsuma was born in Japan. From 2004 to 2007, she studied at the Department of Electrical Engineering, The University of Tokyo, Japan. In 2007, she received her PhD (Eng.) from The University of Tokyo. Since 2013, she has been working as an Associate Professor at the Department of Precision Mechanics, Faculty of Science and Engineering, Chuo University, Tokyo, Japan.
In 2008, Dr. Niitsuma received the Best Paper Award from the Society of Instrument and Control Engineers (SICE), which was followed by the Best Late-Breaking Report Award at the 10th ACM/IEEE International Conference on Human-Robot Interaction in 2015. She has authored or coauthored three book chapters, 19 journal papers, and more than 80 international conference papers, including for IEEE Industrial Electronics Society (IES) conferences.
Dr. Niitsuma has been serving as the Associate Editor of IEEE Transactions on Industrial Informatics since 2017; Secretary of the Technical Committee on Control, Robotics, and Mechatronics since 2016; and a member of the IEEE Medal for Environmental & Safety Technologies Committee since 2015. She was the Publication Co-chair of the IEEE/ASME International Conference on Advanced Intelligent Mechatronics in 2014 and 2018; Interactive Session, Video Session and Demonstration Session Chair of the 2016 IEEE International Symposium on Robot and Human Interactive Communication; and the Finance Chair of the 2014 IEEE/SICE International Symposium on System Integration (SII), which is also an IEEE IES cosponsored international symposium. She is currently Secretary of the Steering Committee of IEEE/SICE SII.

Poster Session PS2-TT06

Aula - Tuesday 28th of August, 11:00
Chairs: Jungmoo Seo, Korea (South), Karol Kyslan, Slovakia

Accurate Rotor Position Detection for Low-Speed Operation of Switched Reluctance Drives

Iliya Ralev, Sebastian Max, Rik W. De Doncker

Nature Inspired Optimal Design of Axial Flux Permanent Magnet Motor for Electric Vehicle

Goga Cvetkovski, Marija Petkovska

Poster Session PS2-TT0-7

Aula - Tuesday 28th of August, 11:20
Chairs: Jan Bauer, Czech Republic, Viliam Fedak, Slovak Republic

How to Choose Electric Motor for Adjustable Speed Drive (ASD)

Slobodan Mircevski, Dragan Vidanovski, Sergey Ryvkin

Motion Synchronization of Biaxial Linear Tooth Belt Drive System

Jukka Parkkinen, Niko Nevaranta, Markku Niemela, Tuomo Lindh, Juha Pyrhonen

Identification of the stator faults in the induction motor drives using parameter estimator

Mateusz Dybkowski, Szymon Bednarz, Maricn Wolkiewicz

A numerical determination of power distribution in the resistance welding machine output circuit

Mariusz Stepien, Boguslaw Grzesik, Zygmunt Mikno

Application of Cuckoo Search Algorithm for Speed Control Optimization in Two-Sided Electrical Drive

Krzysztof Zawirski, Krzysztof Nowopolski, Przemyslaw Siwek

Discrete Sliding Mode Control of Induction Motor Torque and Stator Current Components

Grzegorz Tarchała

Poster Session PS2-TT08

Aula - Tuesday 28th of August, 11:40
Chairs: Javad Abbaszadeh, Iran, Stanimir Valtchev, Portugal

Discrete linear functional observer for the thermal estimation in power modules

Imane Sakhraoui, Baptiste Trajin, Frederic Rotella

Efficiency and Near-Field Emission Comparisons of a Si- and GaN Based Buck Converter Topology

Martin Lenzhofer, Albert Frank

A Combined Approach to Identify Induction Machine Parameters and Design an Extended Kalman Filter for Speed and Torque Estimation

Oliver Wallscheid, Maximilian Schenke, Joachim Böcker

Optimal Current Sensor Position for Switched Reluctance Motor Drives in View of Fault Detection

Wei Peng, Johan Gyselinck, Jin-Woo Ahn, Dong-Hee Lee

Quadcopter Based Automation of Photometric Measurements

Bertalan Pizág, Balázs Vince Nagy

Application of different numerical integration methods for discrete MRASCC estimator of induction motor speed - comparative study

Mateusz Korzonek, Teresa Orlowska-Kowalska

FPGA-Driven DAC with Second Order Sliding Mode Control of Filter Model for Hardware-In-the-Loop Simulators

Tamás Kökényesi, Márton Hegedűs, Szabolcs Verébb, Attila Balogh, Zoltán Sütő, István Varjasi

Pickup magnetic sensors: a dedicated simulation tool to evaluate innovative hybrid materials

Luca Ferraris, Emir Poskovic, Fausto Franchini

Poster Session PS2-TT09

Aula - Tuesday 28th of August, 12:00
Chairs: Georges Engelmann, Germany, Javier Roldan-Perez, Spain

Aluminium electrolytic capacitor model for capacitor materials structure transformation analysis in PWM applications

Laszlo Kovacs, Denes Fodor, Gabor Kohlrusz, isztian Enisz

Detailed off-line parameter identification of Synchronous generator based on frequency response tests

Santiago Bogarra, Antoni Garcia, Manuel Moreno-Eguilaz, Jordi-Roger Riba

MATLAB-based Tool for Teaching of Active Magnetic Bearing Design to Undergraduate Students

Jouni Vuojolainen, Niko Nevaranta, Rafal Jastrzebski, Olli Pyrhonen

Shunt Active Power Filter for Harmonics Mitigation with Harmonic Energy Recycling Function

Marvin Cruse, Katharina Muetze, Rodrigo Guzman Iturra, Peter Thiemann, Christian Dresel

Experimental Setup for the Evaluation of the Duty Cycle Influence over the Distorting Regime

Radu-Florin Marinescu, Petre-Marian Nicolae, Ileana-Diana Nicolae, Cristina-Diana Marinescu, Marcela Popescu

Poster Session PS2-SS01

Aula - Tuesday 28th of August, 12:20
Chairs: Sandor Halasz, Hungary, Tae-Won Chun, Korea (South)

A novel Controller for grid-interfacing solar arrays through five-level diode-clamped converters

Pablo Montero, Francisco Gordillo

An Improved Voltage Ripple Control Algorithm for Modular Multilevel Converter Based Variable Speed Drive

Safia Babikir, Hasan Zidan, Stanimir Valtchev

Time Domain Constrained Optimization of Low Switching Frequency Synchronous Modulation for a Two-Level Three-Phase Inverter

Anvar Khamitov, Alex Ruderman

Simple Fault-Tolerant Control Using Unified Voltage Modulation for Active Neutral Point Clamped (ANPC) Three-Level Inverter

Byoung-gun Park, Jae-woon Lee, Min-hyuk An, Ji-won Kim, Soon-man Kwon

New Five Level Resonant DC/DC Buck Converter

Lilla Litvani, Janos Hamar

Hybrid CCS/FCS model predictive current control of a grid connected two-level converter

Sandor Iles, Tin Barisa, Damir Sumina, Jadranko Matusko

Unipolar Single Reference Multicarrier Sinusoidal Pulse Width Modulation Based 7-level Inverter with Reduced Number of Semiconductor Switches for Renewable Energy Applications

Raj Kiran, Sagar Mahajan Bhaskar, Sanjeevikumar Padmanaban, Frede Blaabjerg, Muhammad Rashid

Optimal PWM for Two-level Inverter fed High Speed Induction Machines

Peter Stumpf, Sandor Halasz

Level Selection Algorithm with Fixed Sampling Frequency for Modular Multilevel Converter

Chan-Ki Kim, Chang-Hwan Park, Jang-Mok Kim

Poster Session PS2-SS02

Aula - Tuesday 28th of August, 12:40
Chairs: Ersan Kabalci, Turkey, Ramazan Bayindir, Turkey

A Programmable Battery Tester with Energy Recycling Technique for Lithium-ion Battery

Chang-Hua Lin, Chien-Ming Wang, Guan-Jung Chen

TT01 - Converter Topologies 3

Plenary Room, Tuesday 28th of August, 14:00
Chairs: Svetlana Bronshtein, Israel, Alexander Ruderman, Kazahstan

The Design and Implementation of a SONAR Power Amplifier

Osman Ulas Sahin

Active Hybrid Filter Applied with a Multi-Cell Switch-Mode Power Amplifier

Helmut L. Votzi, Felix A. Himmelstoss, Hans Ertl

Formulation and Distortion Compensation of Half-Bridge AC-AC Converters Under Asymmetrical Control

Daiki Yaginuma, Kyohei Yamada, Hikaru Kitaoka, Takashi Ohira

Loss Analysis and Field Testing under Various Partial Shading Conditions for Switched Capacitor-Based Cell-Level Power Balancing Utilizing Diffusion Capacitance of Photovoltaic Cells

Yota Saito, Masaya Yamamoto, Masatoshi Uno, Shinichi Urabe

Modular Equalization System Using Phase-Shift Switched Capacitor Converter and Tapped-Inductor-Based Resonant Voltage Multiplier for Energy Storage Systems

Masatoshi Uno, Koki Hasegawa, Kazuki Yashiro

Design Considerations of GaN Transistor based Capacitive Wireless Power Transfer System

Kaspars Kroics, Janis Voitkans, Bohdan Pakhaliuk

TT04 - Electrical Energy 2

Oral Sessions Room 1, Tuesday 28th of August, 14:00
Chairs: Jawad Faiz, Iran, Maoh-Chin Jiang, Taiwan

New Control Strategies for IGBT Based Bridge Type SFCL

Dmitry Baimel, Saad Tapuchi, Nina Baimel

Control Strategy for Two-Stage PV Power Converter During Simultaneous Grid Faults and Irradiance Change

Ivana Isakov, Vladimir Katic, Ivan Todorovic, Stevan Grabic

Introduction to the Analysis of Harmonics and Resonances in Large Offshore Wind Power Plants

Lucia Beloqui-Larumbe, Zian Qin, Pavol Bauer

Comparative Analysis of Small-Signal Dynamics in Virtual Synchronous Machines and Frequency-Derivative-Based Inertia Emulation

Jon Are Suul, Salvatore D'Arco

Over Excitation Limiter for Synchronous Generators with LabVIEW

Mustafa Baha Bayram, Ibrahim Sefa, Selami Balci

Hybrid Microgrid System Design with Renewable Energy Sources

Ersan Kabalci, Yasin Kabalci, Hilal Irgan

TT06 - Electrical Machines 3

Oral Sessions Room 2, Tuesday 28th of August, 14:00
Chairs: Goga Cvetkovski, Macedonia, Zoltan Suto, Hungary

V/f with stabilizing loops versus FOC of Spoke-PM rotor SM drive: control with experiments

Andy-Sorin Isfanuti, Mihaela-Codruta Paicu, Lucian-Nicolae Tutelea, Tiago Staudt, Ion Boldea

Simulation of the Body Motion in a Tube with the Linear HTS Suspension

Ekaterina Kurbatova, Pavel Kurbatov, Pavel Dergachev, Yurii Kulayev

High-Speed Synchronous Reluctance Motors: Computation of the Power Limits by means of Reluctance Networks

Cristian Babetto, Carlos López, Antoni Garcia, Nicola Bianchi, Luis Romeral

Wednesday 29th of August

Keynote address Elena Lomonova

Plenary Room, Wednesday 29th of August, 08:30
Keynote Addresser: Prof. Dr. Elena Lomonova
Presenter: Prof. Dr. Krzysztof Zawirski, Poland

Magnetically levitated bearingless motors

Elena Lomonova, Eindhoven University of Technology, Netherlands

Magnetically levitated planar motors are applied to the wafer scanners in the lithographic industry because of their clean-room and vacuum compatibility. Using the magnetic fields as a bearing mechanism, they have to be controlled actively in six DOFs for stable operation. Therefore, all force and torque components acting on the translator should be accessible and be decoupled. Typically, they provide long stroke xy-movements, a limited stroke along z, and small rotations around all axes.
High-precision planar motors with magnetic levitation and submicrometer accuracy are usually of the PM synchronous type.
In contrast to these levitated planar motors, a novel enabling magnetic suspension system underneath a stationary frame–ceiling robot is researched. It requires an attractive normal force between the frame and the translator to counteract the gravitational force, whereas magnetic levitation above a stationary frame is based on a repulsive normal force. In this respect, basically many topologies (synchronous PM, induction, reluctance ones) are applicable to the magnetically suspended planar motor.
During the keynote lecture several possible topologies for the magnetically suspended planar motor (ceiling robot platform), a thorough electromagnetic analysis and several performance criteria are discussed. First, all force and torque components should be accessible and be decoupled because the magnetically suspended planar motor is an active magnetic bearing. Additionally, the planar motor preferably has a symmetrical behavior along x and y axes. For this reason and owing to its structure, an arrangement with four linear motors with wireless energy transfer from the stationary ceiling has been selected for the magnetically suspended planar motor and intensively researched. All theoretical findings are verified with experiments of fully operational magnetically suspended 6-DoF ceiling robot”.

Elena Lomonova is a Full Professor and Chair of Electromechanics, Power Electronics and Motion Systems at Eindhoven University of Technology (TU/e). Her chair focuses on fundamental and applied research on enabling energy conversion theory, methods and technologies for high-precision, automotive and medical systems. Her research activities span various facets of advanced mechatronics, electromechanics and electromagnetics including rotary electrical machines and drives, linear and planar actuation systems.
Elena Lomonova studied Electromechanical and Control Systems at Moscow Aviation Institute-State University of Aerospace Technology), Russia. After graduating (with honors), she started her industrial carrier at the Research and Development Company ‘Astrophysics’, Moscow, Russia (1982-1987). Afterwards she moved to the Electromechanical and Control Systems Department at State University of Aerospace Technology (MAI), and was active in research, education and industrial projects (1987-1997).
She gained her PhD (with honors, 1993) on researching of powertrain and control systems for autonomous vehicles with multi-level power supply subsystems for on-board loads and laser equipment.
She started working for Delft University of Technology in 1998 before joining TU/e in 2000. In March 2009 she was appointed as a full-time professor and chair of the Electromechanics and Power Electronics group. She is an author and co-author of more than 450 scientific publications and more than 10 patents.

Keynote address Václav Šmídl

Plenary Room, Wednesday 29th of August, 09:00
Keynote Addresser: Dr. Václav Šmídl
Presenter: Dr. Viliam Fedak, Slovak Republic

Predictive control of Power Electronics Systems: Advantages and Challenges

Václav Šmídl, University of West Bohemia, Pilsen, Czech Republic

Control of power electronics converters and drives has been dominated by techniques such as PID controllers due to their simplicity and robustness. Pressure for increase in efficiency, accuracy and robustness of the power electronics applications motivates research of new control and identification techniques that have potential to improve the required properties. Predictive control is one such technique that has the potential offer these advantages. Essentially, predictive control is a way how to design a control strategy by mathematical optimization of behavior of the mathematical model of a controlled system. The key requirement is thus a good mathematical model and sufficient computational power. With increasing availability of high performance computational hardware, and significant improvement in numerical optimization, these techniques are becoming readily available even for low cost applications. Many physical phenomena in the power electronics and drives are well understood which makes the predictive control suitable for present applications. The number of success stories is growing rapidly today. However, the number of issues remain to be solved which makes the topic a promising research field. First, efficient solution for long prediction horizon is a challenge, yet it is necessary to achieve good solution in applications such as spectrum shaping. Second, mathematical models are accurate only to some degree and their accuracy is influenced by varying parameters, unmodeled dynamics and external disturbance. Suitable models for model corrections or calibrations are needed. Third, the performace index (cost function) in present techniques heavily depends on manually tuned coefficients. A methodology that would allow to reduce the need for manual tuning is required. Promising research directions will be outlined.

Václav Šmídl received the Master's and Ph.D. degrees in system engineering from the University of West Bohemia (UWB), Pilsen, Czech Republic, in 1999 and 2005, respectively, and Ph.D. degree in signal processing from the Trinity College Dublin in 2004. He is an Associated Professor at the Faculty of Electrical Engineering, UWB. He is also a researcher at the Czech Academy of Sciences, where he investigates novel methods of system identification and control. He applies these techniques to control of power electronics and drives in the research center RICE of the UWB in Pilsen. He published more than 25 impact factor journal papers and more than a hundred of conference proceedings. His main research topic is advanced and predictive control of non-linear systems with uncertainty and its application in drives and power electronics converters.

Keynote address Gergely György Balázs

Plenary Room, Wednesday 29th of August, 09:30
Keynote Addresser: Dr. Gergely György Balázs
Presenter: Prof. Dr. Raúl Suárez Feijóo, Spain

Innovation in Aviation: Electric and Hybrid Propulsion Systems for Aircrafts

Gergely György Balázs, Siemens Hungary, Budapest, Hungary

Significant noise and air pollution are caused by internal combustion engine driven vehicles.
This problem occurs more dominantly in aviation. Therefore recently special attention is devoted to new technologies that can achieve a significant reduction in energy consumption of air transport, as well as noise and air pollution. Increasing research and development activities have been launched all over the world, aimed at the creation of environmentally friendly all-electric or hybrid drive systems for aircraft.
Currently there are a few aircraft equipped with propulsion system based on this new technology. The hybrid and electric propulsion systems possess several benefits, besides the environment friendly operation, the thrust generation can be separated from the energy storage and -supply. The main goal of the propulsion system developers is to achieve increasing power-and energy density with the elements of the drive system in addition to fulfilling the appropriate security levels.

Novel solutions appear which can revolutionize the aviation industry. The presentation describes the current innovative research and development directions and highlights the Siemens and the Hungarian added values.

Gergely György Balázs received his MSc degree in Electrical Engineering at the Budapest University of Technology and Economics (BME), in 2007; and his Engineering-Economist degree at Corvinus University, Budapest, Hungary, in 2012. He obtained his Ph.D. degree at BME, in 2013. Since 2010, he has been a Lecturer in the Department of Electric Power Engineering at BME, where he presently holds the rank of Associate Professor. Since 2014, he has been the Head of the R&D department at Siemens Hungary. His current research interests include battery management systems and electric dive systems for special applications especially for aviation.
Dr. Balázs manages international Siemens projects and technical leader of EU and Hungarian government co-funded projects. He is the leader of the R&D activities, which are focusing on the fully electric, serial hybrid and parallel hybrid drive systems for aircraft propulsion systems. He was the leader of the first Hungarian high-power wheel-hub motor project.

Keynote address Trygve Thomessen

Plenary Room, Tuesday 29th of August, 10:00
Keynote Addresser: Prof. Trygve Thomessen
Presenter: Prof. Dr. Raúl Suárez Feijóo, Spain

Rapid industrialization of cutting-edge technology – how to close the gap between R&D results and industrial applications.

Trygve Thomessen, PPM ROBOTICS AS, Trondheim, Norway

Increasing uptake of robotic systems is vital for competitiveness in manufacturing industry. Currently, robotization is being more and more implemented in small and medium sized companies (SME). However, the SMEs have often challenging applications, due to their unique processes and requirements to reconfigure the robot system rapidly to comply with various types of production.
From R&D, it has been successfully completed a significant number of projects to develop technology for SMEs. However, still the implementation frequency is comparatively low basically, due to the considerable engineering resources to industrialize the R&D results.
By using, modern technology development methods combined with technology sharing, the R&D results can be directly reused in a greater extent, by enabling a technological ecosystem.

Trygve Thomessen, the managing director of PPM Robotics AS (PPM: PROACTIVE *PROFESSIONAL *MULTIDISCIPLINARY), has his MSc and PhD from the Norwegian University of Science and Technology (NTNU), Trondheim, Norway.
He was until 2001 Scientist at the research institute SINTEF, in Norway.
In 2000, Prof. Thomessen established the high tech, industrial robot technology company, PPM AS, and has since then, been the Managing Director.
Prof. Thomessen was during 2005-2011 part time professor in industrial robotics at NTNU and is currently Industrial Professor at Budapest University of Technology and Economics, Hungary and Visiting Professor at Chuo University, Japan.
Prof. Thomessen has long time experience with industrial targeting R&D within industrial robotics, especially user interaction, programming, and control of complex industrial processes like heavy grinding, assembly and welding. Thus, Prof. Thomessen, represents a strong bridge between R&D, and industrial robot applications.
This is also represented in the slogan of PPM ROBOTICS AS: ".....turning innovation into flexible automation.....:"

TT01 - Converter Topologies 4

Plenary Room, Wednesday 29th of August, 11:00
Chairs: Sachio Kubota, Japan, Denes Fodor, Hungary

Two-Phase Interleaved SEPIC MPPT Using Coupled Inductors in Continuous Conduction Mode

Murat Unlu, Onur Kircioglu, Sabri Camur

Nonisolated single-magnetic multi-port converter based on integration of PWM converter and dual active bridge converter

Yusuke Sato, Hikaru Nagata, Masatoshi Uno

Development of a simple fuzzy logic controller for DC-DC converter

Martin Leso, Jaroslava Zilkova, Peter Girovsky

DPP Converter Using LLC Resonant Voltage Multiplier with a Voltage Divider for Curved Solar Roof of PHEVs

Hayato Sato, Tohru Nakane, Toshiki Shinohara, Masatoshi Uno

Dynamic modelling of braking energy recovered using a bi-directional power station on DC railway electrical network

Nguessan Kouassi, Nicolas Navarro, Tony Letrouve, Herve Caron, Christophe Saudemont, Bruno Francois, Benoit Robyns

Expandable N-Legged Converter for Dynamic Wireless Power Transfer

Mahinda Vilathgamuwa, Prasad Sampath, Gerard Ledwich

TT04 - Electrical Energy 3

Oral Sessions Room 1, Wednesday 29th of August, 11:00
Chairs: Dorin Petreus, Romania, Salvatore D'Arco, Norway

Self-excitation System using High-efficiency Low-power PM Generator

ChongHyun Cho, Dong-Hee Lee, Jin-Woo Ahn

Adjusting the Low Order Harmonics in the Battery Currents for the Microgrid Power Converters with the Instant Islanding Capabilities

Jing Yang, Pengcheng Li, Zhongxiao Cong, Yang Song, Shuai Lu

Novel Segmentation Algorithm for Maximum Power Point Tracking in PV Systems under Partial Shading Conditions

Dmitry Baimel, Saad Tapuchi, Svetlana Bronshtein, Yoram Horen, Nina Baimel

Active control of Induction Generator in Ocean Wave Energy Conversion System

Nikola Vukajlovic, Vladimir Katic, Dragan Milicevic, Bane Popadic

Voltage stability improvement by using a newly designed STATCOM controller in case of high wind penetration cases

Kadir Abaci, Volkan Yamacli, Zhe Chen

Two-stage power converter design and control for renewable energy systems

Efe-Isa Tezde, Halil-Ibrahim Okumus, Muhammed-Muhsin Demir, Fatih Gurel, Hakan Kahveci

TT07 - Motion Control 1

Oral Sessions Room 2, Wednesday 29th of August, 11:00
Chairs: Niko Nevaranta, Finland, Dragan Vidanovski, Macedonia

Overload-capability analysis of PMSM servo- and robot drives using DTC-SVM methods: Part 1

Tibor Vajsz, Laszlo Szamel

Overload-capability analysis of PMSM servo- and robot drives using DTC-SVM methods: Part 2

Tibor Vajsz, Laszlo Szamel

Structural Parameter Optimization to Reduce Cogging Torque of the Consequent Pole In-Wheel Motor

Guming Ma, Xin Qiu, Jianfei Yang, Feifei Bu, Yiping Dou, Wei Cao

Sinusoidal Input Current and Average Speed Control of a Single-Phase Supplied Three-Phase Inverter Drive without Electrolytic Capacitor

Michael Haider, Dominik Bortis, Johann-Walter Kolar, Yasuo Ono

Longitudinal Flight Multi-Control Blending using COTS Based Simulation

Mohamed Guiatni, Khaled Fellah

Motion Control of Dual-motor Interior Permanent Magnet Bearingless Machine

Pekko Jaatinen, Jouni Vuojolainen, Teemu Sillanpaa, Niko Nevaranta, Rafal Jastrzebski, Olli Pyrhonen

SS01 - Multilevel converters

Plenary Room, Wednesday 29th of August, 14:00
Chairs: Byoung-gun Park, Korea (South), Peter Stumpf, Hungary

Modeling of the Modular Multilevel Converters Based on the State-Plane Analysis and SD Coordinate Transformation

Yi-Hsun Hsieh, Fred C. Lee

A Single-Phase Symmetrical Embedded Modified-Quasi-Z-Source Hybrid Three-Level Inverter

Anh-Vu Ho, Tae-Won Chun

Modular Multilevel Converter Performance with Dynamic MVDC Distribution Link Voltage Rating

Aditya Shekhar, Laura Ramirez-Elizondo, Zian Qin, Pavol Bauer

An Isolated Buck-Boost Converter with Hybrid Three-Level Rectifier For Wide and High Output Voltage Applications

Mengxi Li, Yangjun Lu, Yu Yu, Hongfei Wu, Yan Xing, Xudong Ma

Sensorless Feedback Linearization Direct Torque Control (FBL-DTC) for Induction Motor Drive with Five-Level Cascaded H-Bridge Inverter

Mehmet-Ali Usta, Halil-Ibrahim Okumus, Hakan Kahveci, Elif-Selin Durak

Selective Harmonic Elimination with Particle Swarm Optimization in Multilevel Inverters

Elif-Selin Durak, Halil-Ibrahim Okumus, Mehmet-Ali Usta, Hakan Kahveci

TT08 - Sensors

Oral Sessions Room 1, Wednesday 29th of August, 14:00
Chairs: Teresa Orlowska-Kowalska, Poland, Dong-Hee Lee, Korea (South)

Measuerment and Monitoring of Two-Phase Flow with Ultrasonic Sensors

Javad Abbaszadeh, Sahar Sarafi

Novel Electromagnetic Method for Underground Tunnels Detection

Saad Tapuchi, Dmitry Baimel

A Novel Position Error Compensation Method for High-Speed Permanent Magnet Synchronous Motor Sensorless Drive System

Cong Gu, Xiaolin Wang, Xiaoqing Shi, Zhiquan Deng

On-line Resistance Measurement of Substation Connectors Focused on Predictive Maintenance

Akash Kadechkar, Jordi-Roger Riba, Manuel Moreno-Eguilaz, Francesca Capelli, David Gonzalez

Investigation of the Solar Angles Change for Motion Control of Two-Axis Solar Tracking Systems

Merve Aydin, Halil-Ibrahim Okumus, Efe-Isa Tezde, Mustafa Aydemir

Spectrum and Cepstrum Based Speed Determination of Stepper Motors

Gabor Gardonyi, Krisztian Samu

TT07 - Motion Control 2

Oral Sessions Room 2, Wednesday 29th of August, 14:00
Chairs: Grzegorz Tarchała, Poland, Zdenek Hadas, Czech Republic

Integration of Real-Time Electric Power Steering System Matlab/Simulink Model into National Instruments VeriStand environment

Raul-Octavian Nemes, Mircea Ruba, Claudia Martis

Suspension Characteristics of Magnetically Suspended Frame in Inertially Stabilized Platform

Biao Xiang, Waion Wong

Predictive control of the two-mass drive with an induction motor for a wide speed range

Piotr Serkies, Krzysztof Szabat

Active Disturbance Rejection Control based Load Side Speed Controller for Two Mass System with Backlash

Bartlomiej Wicher, Stefan Brock

Parameter Sensitivity Analysis Method for Speed Sensorless Induction Machine Drives Based on Unscented Kalman Filter

Krisztian Horvath, Marton Kuslits

Limited-Jerk Sinusoidal Trajectory Design for FOC of PMSM with H-infinity Optimal Controller

Mehmet-Kaan Mutlu, Ozan Keysan, Baris Ulutas

SS02 - Microgrids and Distributed Generation

Plenary Room, Wednesday 29th of August, 16:30
Chairs: Ersan Kabalci, Turkey, Chang-Hua Lin, Taiwan

Output Power Regulation of a Virtual Oscillator Controlled Inverter

Muhammad Ali, Hendra I. Nurdin, John E. Fletcher

DC Microgrid Topologies and Stability Analysis for Electrified Transportation Systems

Shengzhao Pang, Babak Nahid-Mobarakeh, Serge Pierfederici, Yigeng Huangfu, Guangzhao Luo, Fei Gao

Design of a Power Flow Control Converter for Bipolar Meshed LVDC Distribution Grids

Pavel Purgat, Laurens Mackay, Matthias Schulz, Yunchao Han, Zian Qin, Martin März, Pavol Bauer

Design and Analysis of a Two-Phase Interleaved Boost Converter Based Microinverter

Aydin Boyar, Ersan Kabalci

Identification of the Common Mode Impedance of a Microgrid DC-DC Buck Converter in Normal service and under Insulation Fault

Djelloul Bensaad, AbdeChafik Hadjadj, Achour Ales

DC-DC Boost Converter Stability with Constant Power Load

Mohammed-Kh. Al-Nussairi, Ramazan Bayindir

TT09 (*TT09+TT10+TT11*)

Oral Sessions Room 1, Wednesday 29th of August, 16:30
Chairs: Petre-Marian Nicolae, Romania, Jordi-Roger Riba, Spain

Phase-Matched Frequency Adaptive Repetitive Controller for a Grid-Supporting STATCOM

Javier Roldan-Perez, Aurelio Garcia-Cerrada, Alberto Rodriguez-Cabero, Milan Prodanovic

Continuous SM Controller with Artificial Increase of Relative Degree for Grid-Connected ShuntActive/LCL Filter

Mohamad-Alaaeddin Alali, Yuri. B Shtessel, Jean-Pierre Barbot

Dealing with Distortions Affecting the Equipment for Hydrogen Generation in a Power Plant

Ileana-Diana Nicolae, Petre-Marian Nicolae, Cristian Enache, Lucian-Cristian Scarlatescu

Impact of the Different Parasitic Inductances on the Switching Behavior of SiC MOSFETs

Georges Engelmann, Niklas Fritz, Christoph Lüdecke, Rik W. De Doncker, Zhuxian Zu, Xi Lu, Chingchi Chen, Jun Kikuchi

Virtual Learning Environment for Control Engineering Education

Niko Nevaranta, Krister Grasbeck, Jari-Pekka Haapala, Tuomo Lindh, Pasi Peltoniemi, Hanna Niemela, Olli Pyrhonen

A basic power electronic laboratory experiment allowing comprehensive and structured learning: Multi-phase capacitive loaded full-bridge rectifier

Oguzhan Oztoprak, Ahmet Hava

TT07 - Motion Control 3

Oral Sessions Room 2, Wednesday 29th of August, 16:30
Chairs: Mohamed Guiatni, Algeria, Mateusz Dybkowski, Poland

Total Cost of Ownership Optimization of Manufacturing Machines with Fast Energy Storage

Bert Lenaerts, Ahmed Abdallh, Davy Maes, Branimir Mrak, Timothy Galle, Wim De Waele