ISIE 2011

Gdansk, Poland
27-30 June 2011

20TH IEEE INTERNATIONAL SYMPOSIUM ON INDUSTRIAL ELECTRONICS

GDANSK UNIVERSITY OF TECHNOLOGY

Final Program

IEEE

1951-2011 IES 60th anniversary

POLYTECHNICA GEDANENSIS
PATRIAE MARIQUE FIDELIS

Table of contents

ISIE 2011 *ante portas*

So it has come. It was a long and winding road, paved with effort and concern, that led us to this moment of relief and satisfaction. At the same time, however, it seems to us like it was just yesterday that we attended ISIE 2010, like we were just having a break and now we are together again, resuming ISIE as a never-ending meeting of industrial electronics professionals and good old friends.

The technical program of ISIE 2011 is made of 56 sessions comprising 375 talks prepared by authors from 55 countries. Particularly successful parts of the program content are the keynote speeches and the Industry Forum. The keynote speakers are a dream team, including Hirofumi Akagi, Marek Florkowski, Xavier Roboam, and Johann W. Kolar. The Industry Forum features presentations from such industry giants as Intel, Microsoft, Honeywell, Schneider Electric, BMW, Volkswagen, Det Norske Veritas, HÜTTINGER Elektronik and others. It took a lot of multinational effort to arrive at this quality of program. Great thanks go to all those who offered their precious support in the preparations for this event, in particular the technical track chairs, the special sessions committee and paper reviewers.

Among the questions that conference attendees most often ask themselves is certainly this one: "*Why am I here* ?" We hope it will not be the case with ISIE 2011. We hope that you will enjoy every single second of your stay in Gdansk.

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Barros, Joao Paulo
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Costa, Víctor
Costas, Lucia
Covic, Grant
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Cychowski, Marcin
Da, Yao

Dai, Jingya
Das, B.
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Dervin, Mathieu
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Dobigeon, Nicolas
Dodds, Stephen
Doki, S.
dos Santos, Pedro M.
Du, Shu
Duarte, Jorge L.
Dudzikowski, Ignacy
Duval, Fabrice
Edouard, Ivanjko
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Esmaelpoor, Jamal
Espanet, Christophe
Eyigun, Sevnur
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Ferrero, Alessandro
Ferrieux, Jean-Paul
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Fischer, Peter
Frank, Heinz
Franquelo, Leopoldo G.
Freijedo, Francisco D.
Frey, David
Fuchs, Friedrich W.
Fuertes, Josep M.
Fujimoto, Hiroshi
Fujimoto, Yasutaka
Fukuda, Shoji
Fung, Wai-Keung
Galopin, Nicolas
Garbat, Piotr
Gasulla, Manel
Gaubert, Jean Paul
Gaztanaga, Haizea
Geramifard, Omid
Ghita, Ovidiu
Giral, Roberto
Godler, Ivan
Göhner, Peter
Goksu, Omer
Gomes, Luis
Gonzalez, Sergio A.
Gopakumar, K.
Gopalakrishnan, Sathish
Grabowski, Szymon
Grandi, Gabriele
Grau, Antoni
Graziani, Salvatore
Green, Andrew
Grzesiak, Lech
Gu, Zonghua
Guan, Che
Guerrero, Josep M.
Guo, Liping
Gupta, Rajesh
Gurgen, F.
Guzinski, Jaroslaw
Habib, Maki K.
Hace, A.
Haddoun, Abdelhakim
Hagiwara, Makoto
Hameyer, Kay
Han, Chong
Hanzelka, Zbigniew
Hara, Susumu
Hartman, Marek
Hashimoto, Seiji
Hava, Ahmet
Hernando, Marta
Hirose, Noriaki
Hofmann, Wilfried
Holtz, Joachim
Hong, Seoung Ho
Hothongkham, Prasopchok
Hren, Alenka
Hui, S. Y. Ron
Huneault, Maurice
Hussain, Ayman
Iannizzotto, Giancarlo
Iannuzzo, Francesco
Ibrahim, Yousef
Ippolito, Mariano
Iqbal, Atif
Ishikawa, Jun
Ito, Masahide
Iwan, Krzysztof
Iwanski, Grzegorz
Iwasaki, Makoto
Iyer, Narayanaswamy. P.R.
Izykowski, Jan
Jahn, Marco
Jammes, Francois
Jappe, Tiago
Jarzebowicz, Leszek
Jasinski, Marek
Jeannin, Pierre-Olivier
Jezernik, Karel
Jiang, Yong
Jirasereeamornkul, Kamon
Jurado, F.
Kabzinski, Jacek
Kanaan, H.Y.
Kannoju, Praveen Kumar
Karnouskos, Stamatis
Kastner, Wolfgang
Katsura, Seiichiro
Kawafuku, Motohiro
Kazmierkowski, Marian P.
Kennel, Ralph
Kerekes, Tamas
Kim, S.-Y.
Kim, Seyoung
Kirrmann, Hubert
Kjar, Soren B.
Koczara, Wlodzimierz

Komada, Satoshi
Komurcugil, Hasan
Kostas, Alexis
Kot, Radoslaw
Kouro, Samir
Koutroulis, Eftichios
Kowalski, Czeslaw T.
Krah, Jens Onno
Krishnamurthy, Mahesh
Krzeminski, Zbigniew
Kubota, H.
Kung, Ying-Shieh
Kwon, Dong-soo
Laboure, Eric
Lai, Yen-Shin
Lalili, Djaafer
Lam, Yuet Ming
Lamich, Manel
Laroche, Edouard
Latafat, Hamed
Lavado-Villa, Luiz-Fernando
Le Bunetel, Jean-Charles
Lee, Joo-Ho
Lee, Ju-Jang
Le-Huy, Philippe
Leidhold, Roberto
Leitao, Paulo
Lembeye, Yves
Leon, Jose I.
Lezana, Pablo
Li, Shuhui
Li, Zhihao
Lian, Feng-Li
Lim, Shu Fan
Lim, Wee Gin
Lima, Celson
Lima, Kleber
Liserre, Marco
Liu, Xue
Lo Bello, Lucia
Lobo, Jorge
Loomis, Jack
Lopez, Oscar
Loron, Luc
Lujak, Marin
Lukic, Srdjan
Luna, Alvaro
Luszcz, Jaroslaw
Machmoum, Mohamed
Madawala, Udaya
Mademlis, Christos
Maeda, Yoshihiro
Maestro, Juan A.
Maia, José
Mak, Terrence
Malinowski, Aleksander
Malinowski, Mariusz
Man, Kim F.
Mancilla-David, Fernando
Manic, Milos
Manninen, Keijo
Manus, Henry
Margato, Elmano
Margueron, Xavier
Marinescu, Bogdan
Marques Cardoso, Antonio J.
Marques, Gil
Marques, Hugo
Marroyo, Luis
Marti Colom, Pau
Martinez, Herminio
Martins, Carlos Almeida
Massoud, Ahmed M.
Mastromauro, Rosa
Matas, Jose
Matsuse, Kouki
Mendes, Marco
Merdan, Munir
Mestre, Pedro
Michna, Michal
Mielczarski, Wladyslaw
Minakata, Hideaki
Mirabella, Orazio
Mitsantisuk, Chowarit
Mitsukura, Yasue
Miyazaki, Toshimasa
Mlodzikowski, Pawel
Mokryani, Geev
Mondal, Gopal
Monfared, Radmehr
Monmasson, Eric
Monteiro, Joaquim
Monteiro, Luís Fernando
Moradewicz, Artur J.
Morawski, Michal
Moson, Ireneusz
Mousavi, Mohammad
Munoz Aguilar, Raul Santiago
Munteanu, Iulian
Murakami, Toshiyuki
Mutoh, Nobuyoshi
Mutschle, Peter
Nadir, Idir
Nagata, Fusaomi
Nalepa, Radoslaw
Namerikawa, Toru
Natori, Kenji
Navarro, Denis
Navet, Nicolas
Neto, Horacio
Nichita, Cristian
Nieznanski, Janusz
Ninad, Nayeem Ahmed
Nishi, Hiroaki
Nogueiras, Andres A.
Novak, Thomas
Oda, Naoki
Ohba, Yuzuru
Ohishi, Kiyoshi
Okumus, H. Ibrahim
Oliva, Gabriele
Oliveira, Arnaldo
Oliveira, Rodolfo
Orlowska-Kowalska, Teresa
Ortega, Ruben
Ouhrouche, Mohand
Ozdemir, Engin
Pacas, Mario
Palma, Joao
Palma, Luis
Panda, S.K.
Park, Jae Do
Park, Kang-Bak
Pedro, Eduarda
Pelczynski, Pawel
Pellizzoni, Rodolfo
Penya, Yoseba
Pera, Marie-Cecile

Perez, Marcelo
Peric, Nedjeljko
Perron, Marc
Petrella, Roberto
Petrone, G.
Pham, Duc
Piasecki, Szymon
Pichon, Lionel
Piepenbreier, Bernhard
Pigazo, Alberto
Pina Martins, Antonio
Pindado, Rafael
Pinto, Sonia
Pique, Robert
Piquet, Hubert
Pires, Luis
Pires, Victor
Ponce Cruz, Pedro
Popescu, Corina
Popescu, Mihaela
Popov, Marjan
Portugal, Paulo
Potdar, Vidyasagar
Proenza, Julian
Quintans, Camilo
Racewicz, Szymon
Rafal, Krzysztof
Raison, Bertrand
Ramirez, Juan M.
Ramos, Carlos Joao
Ramos-Paja, Carlos Andrés
Rao, Raveendra
Rauh, Andreas
Redondo, Luis
Regnier, Jeremi
Reis, Cecilia
Resende, Maria José
Retiere, Nicolas
Reyes, Manuel
Ribeiro, Luis
Richardeau, Frederic
Riedl, Matthias
Rigatos, Gerasimos
Riu, Delphine
Robet, Pierre-Philippe
Robyns, Benoit
Rocha, J. G.
Rodriguez, Pedro
Rodriguez-Andina, Juan J.
Rolak, Michal
Romanowski, Andrzej
Ronkowski, Mieczyslaw
Rosa, Paulo
Rosenqvist, Fredrik
Rouger, Nicolas
Roye, Daniel
Ruan, Xinbo
Ryvkin, Sergey
Saadate, Shahrok
Sack, Lothar
Sainz, Luis
Santana, Pedro
Santos, Marcelino
Santos, Natália
Sareni, Bruno
Savaghebi, Mehdi
Sawada, Hideyuki
Schanen, Jean-Luc
Schmidt, Michael
Schoenauer, Marc
Schroeder, Guenter
Schroeter, Christof
Schumacher, Walter
Sedlak, Marcin
Seki, Kenta
Selisteanu, Dan
Sentis, Luis
Sepúlveda Freitas, Manuel Joao
Sequeira, Joao
Sera, Dezso
Serban, Ioan
Serna, Eva
Serodio, Carlos
Sham, Bruce
Shi, Xiaodong
Shibata, Masaaki
Shimono, Tomoyuki
Shmilovitz, Doron
Siano, Pierluigi
Siarry, Patrick
Sierociuk, Dominik
Sikorski, Andrzej
Silva, Fernando A.
Silva, Manuel
Simonot-Lion, Francoise
Singh, Bhim
Skobelev, Petr
Slama Belkhodja, Ilhem
Sleszynski, Wojciech
Slutka, Petr
Smierzchalski, Roman
Soares, Vasco
Sobczuk, Dariusz
Solsona, Jorge
Soroka, Anthony
Sousa, Duarte
Spiazzi, G.
Stala, Robert
Staudt, Volker
Steimer, Peter K.
Stein, Denis
Stiebler, Manfred
Strasser, Thomas
Strumillo, Pawel
Strzelecki, Michal
Stynski, Sebastian
Sun, Kai
Swierczynski, Maciej
Szabat, Krzysztof
Szalag, Wojciech
Szczepankowski, Pawel
Ta, Minh C.
Tabbache, Bekheira
Takahashi, Satoru
Teja, A. V. Ravi
Tenreiro Machado
Theolier, Loic
Thomae, Reiner
Thompson, David
Thramboulidis, Kleanthis
Tonkoski, Reinaldo
Tourneret, Jean-Yves
Trentesaux, Damien
Trintis, Ionut
Trujillo, Cesar
Tsuji, Toshiaki
Tsuruta, Kazuhiro
Turzynski, Marek

Uchimura, Yutaka
Urbanski, Konrad
Urushihara, Shiro
Valderrama, Hugo
Valdes, Maria D.
Valentini, Massmo
Valenzano, Adriano
Valério, Duarte
Vasak, Mario
Vaseghi, Babak
Vasques, Francisco
Vasquez, Juan C.
Vazquez, Felix Iglesias
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Vidal, Ana
Villwock, Sebastian
Vinassa, Jean-Michel
Vitale, G.
Vittek, Jan
Vodden, John
Vollaire, Christian
Vrba, Pavel
Waffenschmidt, Eberhard
Wagner, Bernardo
Wang, Jiacheng
Wang, Qixin
Wang, Zhaoxia
Weber, Karl
Wegiel, Tomasz
Wegrzyn, Marek
Wei, Zhang
Williamson, Sheldon
Wilmer, Albert
Wlas, Miroslaw
Woirgard, Eric
Wojciechowski, Daniel
Wrona, Grzegorz
Wu, C.L.
Wurtz, Frederic
Xu, Wei
Yang, Fei
Yang, Guang
Yashiro, Daisuke
Yeh, Chia-Chou
Yepes, G.
Yin, GuoQing
Yiu, Cedric
Yokokura, Yuki
Yu, Chiwai
Yu, Hao
Yubai, Kazuhiro
Zaidi, Syed Sajjad H.
Zanma, Tadanao
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General information

Currency and credit cards

The official currency of Poland is the Polish Zloty (the shorthand normally used is zl rather than the formal pln). The exchange rate is roughly 4 zl for one Euro. Credit cards are accepted for payments almost everywhere, except for smaller shops, taxis and public transport. Exchange offices (called Kantors) offer better exchange rates than banks.

Airport

The Lech Walesa Airport (Port Lotniczy im. Lecha Walesy) is located to the west of the Trojmiasto bypass, where Trojmiasto (TriCity) stands for Gdansk, Sopot and Gdynia taken together – consult the map below. The Airport is 10 km away from Gdansk city center.

You can access your hotel by taking a taxi or a city bus, or by a rented car. There are two bus lines connecting the Airport with the central Gdansk: line 210 (Airport – Gdansk Glowny Railway Station) and line 110 (Airport – Gdansk-Wrzeszcz Railway Station). From Gdansk Glowny Railway Station you are within a walking distance from the hotel MERCURE HEVELIUS GDANSK. The departure hours of the buses can be found at http://www.airport.gdansk.pl/#/passenger/arrival1/transfer.

Taxi

For the ride from the airport to the hotel, please take a taxi marked City Plus Taxi. This company is recommended by the airport. There are lots of freelance taxi drivers who don't have good reputation, and they love to fleece strangers. A taxi ride from the airport to the hotel should cost around 60-70 zl for SHERATON SOPOT, 40-50 zl for MERCURE HEVELIUS GDANSK, about 50 zl for NOVOTEL GDANSK MARINA and ORBIS POSEJDON, and about 40 zl for the STUDENT HOSTEL DS1 (these are all daytime fares; the nightime fares are 50% higher and are used between 22:00 and 6:00).

University campus

The Gdansk University of Technology is located close to the historical center of Gdansk. The back cover of this guide shows the campus plan (note that the plan is not properly orientated relative the geographical directions). You can nevertheless locate the Narutowicza street (so we hope) leading to the Main Building (building No. 1). The two courtyards of that building will be used for the Welcome Party on June 28th. Held in parallel – in building No. 18, called "Bratniak" – will be the Young Engineers' Banquet. Building No. 16 is the main building of the Faculty of Electrical and Control Engineering, the department responsible for the organization of the conference. Most of the conference activities, including all tutorials and technical sessions, coffee breaks and lunches, will be held in building No. 22, belonging to the Faculty of Electronics, Telecommunications and Informatics.

IMPORTANT Just in case, we are the *Gdansk University of Technology* (or *Politechnika Gdanska*) which should not be confused with the *University of Gdansk* (*Uniwersytet Gdanski*).

Internet access

Wireless Internet access will be available to all conference attendees in building No. 22 (dedicated conference Wi-Fi and Eduroam).

Conference bus service

The ISIE 2011 organisers will hire bus services to provide you with the transport between your hotels and the university (including the transport to and from the Gala Dinner dinner at Pick & Roll Club in Sopot on June 29th). The information about boarding hours will be provided on the ISIE 2011 website and in the conference hotels: SHERATON SOPOT, MERCURE HEVELIUS GDANSK, NOVOTEL GDANSK MARINA and ORBIS POSEJDON.

Public transport

The public transport services in Trojmiasto include bus lines, tramway lines (Gdansk only), trolleybus lines (Gdynia only) and the city train called SKM. The latter is the backbone of the public transport in Trojmiasto, connecting Gdansk, Sopot and Gdynia by a single stretch of rails. To board an SKM train, you should buy and punch (fr. composter) a ticket. Ticket offices can be found at most SKM stops. The *Gdansk Glowny* stop is within 3-5 minutes walk from the hotel MERCURE HEVELIUS GDANSK. NOVOTEL GDANSK MARINA is more distant from the station (maybe 30 minutes walk). The *Sopot* station is within 10 minutes walk from SHERATON SOPOT. *Gdansk Oliwa* is the station closest to ORBIS POSEJDON, but not very close (30-35 minutes walk). The stop closest to STUDENT HOSTEL DS1 is *Gdansk Wrzeszcz* (about 20 minutes walk). The *Gdansk Politechnika* stop is within 5 minutes walk

from the university's Main Building. Leaving the platform, go to the left (relative the Gdansk-to-Gdynia direction) to reach the main street (Aleja Zwyciestwa). Cross the street and cut the park area diagonally to the right and you will find yourself at the main gate to the university.

For more information on the SKM and basic information on moving around by public busses, tramways and trolleybuses consult www.isie2011.pl/travel.

Keynote speeches

Keynote speech 1: **New Trends in Medium-Voltage Power Converters and Motor Drives**

Tuesday, June 28, 10:30 - 11:30 Auditorium Max

Hirofumi Akagi, Tokyo Institute of Technology, Japan

OUTLINE

The speech starts by describing a five-level diode-clamped PWM inverter intended for a medium-voltage motor drive without regenerative braking. It is equipped with a specially designed circuit that plays an important role in achieving voltage balancing of the four split dc capacitors connected in series at the dc input terminals of the inverter. The voltage-balancing circuit frees the inverter to concentrate on the motor control. Then, we pass to an intensive discussion on the modular multilevel cascade converter (MMCC) family that are characterized by the modular structure of either bridge cell or chopper cell. The four family members are compared from various points of view, along with applications of two promising members to a medium voltage battery energy storage system and a medium-voltage motor drives for energy savings.

BIOGRAPHY

Hirofumi Akagi (M'87-SM'94-F'96) was born in Okayama, Japan, in 1951. He received the B. S. degree from the Nagoya Institute of Technology, Nagoya, Japan, in 1974, and the M. S. and Ph. D. degrees from the Tokyo Institute of Technology, Tokyo, Japan, in 1976 and 1979, respectively, all in electrical engineering. In 1979, he joined the Nagaoka University of Technology, Nagaoka, Japan, as an Assistant and then Associate Professor in the department of electrical engineering. In 1987, he was a Visiting Scientist at the Massachusetts Institute of Technology MIT, Cambridge, for ten months. From 1991 to 1999, he was a Professor in the department of electrical engineering at Okayama University, Okayama, Japan. From March to August of 1996, he was a Visiting Professor at the University of Wisconsin, Madison, and then MIT. Since January 2000, he has been a Professor in the department of electrical and electronic engineering at the Tokyo Institute of Technology.

His research interests include power conversion systems, motor drives, active and passive EMI filters, high-frequency resonant inverters for induction heating and corona discharge treatment processes, and utility applications of power electronics such as active filters, self-commutated BTB (back-to-back) systems, and FACTS (flexible ac transmission systems) devices. He has authored and coauthored more than 90 IEEE Transactions papers and two invited papers published in *Proceedings of the IEEE* in 2001 and 2004. The total citation index for all his papers in *Google Scholar* is more than 10,000. He has made presentations many times as a keynote or invited speaker internationally.

He was elected as a Distinguished Lecturer of the IEEE Power Electronics and Industry Applications Societies for 1998-1999. He has received five IEEE Transactions Prize Paper Awards and nine IEEE Conference Prize Paper Awards. He is the recipient of the 2001 IEEE William E. Newell Power Electronics Award, the 2004 IEEE Industry Applications Society Outstanding Achievement Award, and the 2008 IEEE Richard H. Kaufmann Technical Field Award. Dr. Akagi served as the President of the IEEE Power Electronics Society for 2007-2008.

Keynote speech 2: **Exploitation stresses and challenges in diagnostics of electrical industrial equipment**

Tuesday, June 28, 11:30 - 12:30 Auditorium Max

Marek Florkowski, ABB Corporate Research, Poland

OUTLINE

Exploitation strategies of electric power and industrial equipment, stimulated mainly by economic and environmental trends, play a crucial role in ensuring uninterrupted power delivery and continuous operation. The diagnostics of industrial equipment is particularly important in this context, due to both operational multistresses and the strive for higher and higher voltage levels as well as due to increasing requirements with respect to safety, security and reliability in electric power and industrial networks. Modern diagnostics is a multidisciplinary domain. The development of power electronics, sensors, optoelectronics, communication, information technology and new materials has a strong influence on new approaches. This keynote will address the challenges and trends of modern diagnostics with a special focus on electric insulation systems exposed to power electronics stimuli. The main challenge nowadays is the proper interpretation of acquired diagnostic information and correlation with physical phenomena and degradation processes. Various complementary methods will be presented along with industrial examples; like the signal and image processing methods applied for assessing pulse diagnostic symptoms coming from stochastic signals of partial discharges in various structures of the insulation systems and high frequency response analysis applied to winding assessment. New challenges caused by electronic converters subjecting and stressing the electric insulation systems with high slew rate and repetition frequency of switching pulses is shown. The noninvasive and non-destructive character of applied methods make them especially attractive for diagnostics and monitoring purposes. Further, from the global perspective, reliability and safety drive the recent trends in industrial diagnostics.

BIOGRAPHY

(M'96-SM'06) IEEE Senior Member, has been with ABB Corporate Research Krakow Poland since 1997. He has been Director of the ABB Corporate Research Center in Poland since 1999 and Technical Director ABB Poland since 1999. He graduated from University of Science and Technology (AGH) in Krakow (Poland) with a Master Degree in 1990, PhD degree 1994. In 2009 he has obtained the habilitation degree (Dr.Hab.). From 1990 to 1992 he was employed at ABB Corporate Research Center in Baden-Dättwil, Switzerland. From 1993 to 1997 he was responsible for Physical Instruments company and involved in several scientific grants with universities.

His background comprises: electronics, information technology and high voltage engineering with special focus on diagnostics and monitoring, insulation systems especially partial discharge measurements, impact and mitigation of transients in power systems, embedded systems, sensors and data acquisition, signal and image processing including wavelets, neural network based pattern recognition, multiphysical simulations and modeling.

He has published 170 papers in conference proceedings and journals, is an author and co-author of 3 books and 18 patents. He is IEEE Senior Member, CIGRE Member, and since 2010 AdCom member of IEEE Dielectrics and Electric Insulation Society. He has served for many years as a reviewer for conference papers and journals including IEEE, IET, MST. Ha has been an active member of: High Power and High Voltage Section Committee for Electrotechnics Polish Academy of Science, Innovation Council at the Malopolska Marshal (Kraków/Poland) and Scientific Advisory Committee of some conferences. Since many years he has collaborated with universities in the frame of research and student's education.

Keynote speech 3: **New trends and challenges of electrical networks embedded in "more electrical aircraft"**

Wednesday, June 29, 9:00 - 10:00 Auditorium Max

Xavier Roboam, Université de Toulouse, LAPLACE (CNRS/INPT/UPS), ENSEEIHT, France

OUTLINE

This speech addresses the main trends and future challenges of electrical networks embedded in "more electrical aircraft" especially in the fields of industrial electronics and energy conversion. In the first part, the current context and new standards are put forward, emphasizing the main evolutions on aircraft architectures, from AC fixed frequency networks, variable frequency to "Bleedless" architectures. The main characteristics of more electrical aircraft are discussed, especially in terms of power management rationalization, maintenance, health monitoring capacity, etc. The second part deals with the new trends and challenges of "more and more" electrical aircraft linked with power integration and new architecture with HVDC standard. Recent methodological orientations towards "Integrated Optimal Design" are discussed with representative examples. Finally, new trends towards reversible and hybrid HVDC networks including new storage devices are also emphasized.

BIOGRAPHY

Xavier Roboam (M-96) was born in Toulouse, France in 1964. He received the PHD of 'INPT' (Institut National Polytechnique de Toulouse), in the field of 'Electrical Engineering' in 1991 and obtained the L. Escande award for the best PHDs during de current year. He has been working as R&D engineer for 'Moteurs Leroy Somer' company between 1991 and 1992.From 1992, he has been working as CNRS (Centre National de la Recherche Scientifique) full time researcher at the 'LEEI' then 'LAPLACE' (Laboratoire Plasma & Conversion d'Energie) lab in the 'Université de Toulouse', France.

He currently acts as ''Directeur de Recherches'' and is the head of the ''GENESYS'' (Groupe ENergie Electrique & SYStémique) research group (www.laplace.univ-tlse.fr). From 2005, he has been involved as permanent consulting expert for Airbus Operation SAS contributing to 'new architectures of electrical embedded network for future More Electrical Aircrafts'.

His research interests include ''integrated design methodologies'' in electrical engineering especially for system modelling & analysis (causal & bicausal Bond Graphs) and Integrated Optimal Design (multi objective evolutionary algorithms). He has been working on new architectures and energy management for embedded networks (railway, aircrafts) and sustainable energy production (hybrid wind power & photovoltaic systems for rural electrification, pumping, desalination). He has co authored or authored more than 160 publications with 8 invited papers; 6 participations to edited books and 9 patents & PCTs. He has directed or co directed 23 PHD students and has been involved in a large set of industrial cooperation actions with Airbus, Alstom Transport, EADS, EDF R&D, GIAT/Nexter, Liebherr Aerospace, Moteurs Leroy Somer, SAFT, Schneider Electric, Siemens Automotive, SNCF, Thales Avionics.

Keynote speech 4: **Conceptualization and Multi-Objective Optimization of the Electric System of an Airborne Wind Turbine**

Thursday, June 30, 9:00 - 10:00 Auditorium Max

Johann W. Kolar, ETH Zurich, Switzerland

OUTLINE

Airborne Wind Turbines (AWT) represent a radically new and fascinating concept for future harnessing of wind power. This concept consists of realizing only the blades of a conventional wind turbine (CWT) in the form of a power kite flying at high speed perpendicular to the wind. On the kite are mounted a turbine, an electrical generator and a power electronics converter. The electric power generated is transmitted via a medium voltage cable to the ground. Because of the high flight speed of the power kite, several times the actual wind speed, only a very small swept area of the turbine is required according to Betz's Law and/or a turbine of low weight for the generation of a given electric power. Moreover, because of the high turbine rotational speed, no gear transmission is necessary and the size of the generator is also reduced. For takeoff and landing of the power kite, the turbines act as propellers and the generators as motors, i.e. electric power is supplied so that the system can be maneuvered like a helicopter. In this speech the configuration of power electronics converters for the implementation of a 100kW AWT will be considered. The major aspect here is the trade-off between power-to-weight ratio (W/kg) and efficiency. The dependence of cable weight and cable losses on the voltage level of power transmission will be investigated, and a comparison made of low voltage (LV) and medium voltage (MV) versions of generators. Furthermore, the interdependence of the weight and efficiency of a bidirectional Dual Active Bridge dc–dc converter for coupling the rectified output voltage of a LV generator to the MV cable will be discussed. Based on this, the concept offering the best possible compromise of weight and efficiency in the power electronics system will be presented, along with the derivation of a model of the control behavior for both power flow directions. The proposed control structure and its dimensioning will then be discussed. Furthermore, questions of electromagnetic compatibility and electrical safety will be treated. In conclusion, the essential results of the work will be summarized and an outlook on future research will be given. The written version of this talk offers an Appendix which summarizes the aerodynamic fundamentals of both systems (CWT and AWT) in a highly simplified form, enabling the reader to make simplified calculations and a comparison of a CWT with an AWT.

BIOGRAPHY

Johann W. Kolar (F´10) received his M.Sc. and Ph.D. degree (summa cum laude / promotio sub auspiciis praesidentis rei publicae) from the University of Technology Vienna, Austria. Since 1984 he has been working as an independent international consultant in close collaboration with the University of Technology Vienna, in the fields of power electronics, industrial electronics and high performance drives. He has proposed numerous novel PWM converter topologies, and modulation and control concepts, e.g., the VIENNA Rectifier and the Three-Phase AC-AC Sparse Matrix Converter. Dr. Kolar has published over 350 scientific papers in international journals and conference proceedings and has filed 75 patents. He was appointed Professor and Head of the Power Electronic Systems Laboratory at the Swiss Federal Institute of Technology (ETH) Zurich on Feb. 1, 2001.

The focus of his current research is on AC-AC and AC-DC converter topologies with low effects on the mains, e.g. for power supply of data centers, More-Electric-Aircraft and distributed renewable energy systems. Further main areas of research are the realization of ultra-compact and ultra-efficient converter modules employing latest power semiconductor technology (e.g. SiC), novel concepts for cooling and EMI filtering, multi-domain/scale modeling/simulation and multi-objective optimization, physical model-based lifetime prediction, pulsed power, and ultra-high speed and bearingless motors.

He received the Best Transactions Paper Award of the IEEE Industrial Electronics Society in 2005, the Best Paper Award of the ICPE in 2007, the 1st Prize Paper Award of the IEEE IAS IPCC in 2008, the IEEE IECON Best Paper Award of the IES PETC in 2009, the 2009 IEEE Power Electronics Society Transaction Prize Paper Award and the 2010 Best Paper Award of the IEEE/ASME Transactions on Mechatronics. He also received an Erskine Fellowship from the University of Canterbury, New Zealand, in 2003. He initiated and/or is the founder/co-founder of 4 spin-off companies targeting ultra-high speed drives, multi-domain/level simulation, ultra-compact/efficient converter systems and pulsed power/electronic energy processing. In 2006, the European Power Supplies Manufacturers Association (EPSMA) awarded the Power Electronics Systems Laboratory of ETH Zurich as the leading academic research institution in Power Electronics in Europe.

Dr. Kolar is a Fellow of the IEEE and a Member of the IEEJ and of International Steering Committees and Technical Program Committees of numerous international conferences in the field (e.g. Director of the Power Quality Branch of the International Conference on Power Conversion and Intelligent Motion). He is the founding Chairman of the IEEE PELS Austria and Switzerland Chapter and Chairman of the Education Chapter of the EPE Association. From 1997 through 2000 he has been serving as an Associate Editor of the IEEE Transactions on Industrial Electronics and since 2001 as an Associate Editor of the IEEE Transactions on Power Electronics. Since 2002 he also is an Associate Editor of the Journal of Power Electronics of the Korean Institute of Power Electronics and a member of the Editorial Advisory Board of the IEEJ Transactions on Electrical and Electronic Engineering.

Tutorials

Tutorials chart

MONDAY, JUNE 27

12:00 - 14:00	Registration		
14:00 - 16:00	**Tutorial 1** CUPS & V2G – elements of the SmartGrid *Room 209*	**Tutorial 2** Microgrids: Integration of renewable energy resources into the Smartgrid *Room 204*	**Tutorial 3** Pulse Width Modulated Voltage Issues in Motor Drive Systems *Room 205*
16:00 - 16:30	Coffee break		
16:30 - 18:30	**Tutorial 1** CUPS & V2G – elements of the SmartGrid *Room 209*	**Tutorial 2** Microgrids: Integration of renewable energy resources into the Smartgrid *Room 204*	**Tutorial 3** Pulse Width Modulated Voltage Issues in Motor Drive Systems *Room 205*
18:30 - 19:30	Registration		

Tutorials details

Tutorial 1: **CUPS & V2G – elements of the SmartGrid**
Monday, June 27, 14:00 - 18:30 Room 209
Grzegorz Benysek, University of Zielona Góra, Poland

OUTLINE

The major aim of this tutorial is to present the features, solutions and applications of the power electronics arrangements like CUPS, V2G useful in future smart electrical energy networks.

Over the last few years, electrical energy consumption has continually grown and, at the same time, investment in the T&D (Transmission and Distribution) infrastructure has correspondingly declined. Traditional solutions for upgrading the electrical system infrastructure have been primarily in the form of new power plants, new transmission lines, substations, and associated equipment. However, as experience has proven, the process of authorizing, locating, and constructing new transmission lines has become extremely difficult, expensive and time-consuming. As a result, the power grid is under stress, resulting in compromised reliability and higher energy costs.

Despite the above problems, system reliability is vital and cannot be compromised. To overcome this problem, grid operators are moving away from radial systems towards networked; however this degrades controllability of the network because current flows along particular lines which cannot easily be controlled. The situation is even worse if an incident such as loss of a line results in

overload, increasing the possibility of a blackout. Additionally, rapid load growth leads to jamming on key lines which, in consequence, leads to an inefficient operation of energy markets.

The answer seems to lie in transforming the current EPS (Electrical Power System) into SmartGrid. Future grids (SmartGrid) will be strong, more flexible, reliable, self-healing, fully controllable, asset efficient and will be a platform to make possible the coexistence of smart-self-controlling grids with great numbers of DGs (Distributed Generation) and large-scale centralized power plants. The need for modifications, demands to remove the barriers to the large-scale exploitation and integration of DGs and other players, will necessitate research and development new innovative technologies from generation, transmission and distribution to communication tools, with far more sensors than at present. Thus it is envisaged that FACTS (Flexible AC Transmission Systems), CUPS (Custom Power Systems), ESS (Energy Storage Systems), DG, V2G (Vehicle to Grid), smart end-user appliances together with communications will be at the heart of the future SmartGrid.

SmartGrid will allow the customer to take an active role in the supply of electricity, which can help the electricity system respond to equipment failures, weather-related emergencies, and other conditions. At present, the system operator must maintain enough excess generating capacity online or quickly available to continue supplying system load if a large generating unit or transmission line fails. In SmartGrid, much of that reserve could be provided by EPS or small DG, ESS units located near end-user sites.

Summarizing, a modernized SmartGrid would create EPS that:

- Will reduce peak loads and generate reserve margins.
- Will delete capital costs of new T&D infrastructure as well as generating plants.
- Will lower T&D line losses together with operation and maintenance costs.
- Will redirect power flows, change load patterns, improve voltage profiles and stability.
- Will enable loads ESS and DG to participate in system operations.
- Through extensive monitoring, quick communications, and feedback control of operations, will have much more information about system rising problems before they affect service.
- Provide system utilities with advanced visualization tools to enhance their ability to oversee the system.

The proposed tutorial arises from conviction that it is necessary to re-think the basic philosophy governing the electricity distribution systems. In author's opinion there is need to fully exploit the potential advantages of renewable energy sources and distributed generation which should not only be connected, but also fully integrated into the distribution system just to increase the efficiency, flexibility, safety, reliability and quality of the electricity and networks. For that reason transformation the current electricity grids into a SmartGrid (resilient and interactive) necessitate the development, propagation and demonstration of key enabling cost competitive technologies (e.g. innovative interconnection solutions, storage technologies for renewable energy sources, power electronics etc.).

On the base of above the major aim of this tutorial is to present the features, solutions and applications of the power electronics arrangements useful in future smart electrical energy networks.

SCHEDULE

1. Introduction

2. T&D selected problems

3. SmartGrid – the concept

4. CUPS – solutions to selected problems of T&D

5. V2G – solution to selected problems of T&D

6. Conclusions

Tutorial 2: **Microgrids: Integration of renewable energy resources into the Smartgrid**

Monday, June 27, 14:00 - 18:30 Room 204

Josep M. Guerrero, Technical University of Catalonia, Barcelona, Spain

OUTLINE

Worldwide electrical grids are expecting to become smarter in the next future. In this sense, the increasing interest in intelligent microgrids able to operate in island or connected to the grid, which will be a keypoint to cope with new functionalities, as well as integration of renewable energy resources.

A microgrid can be defined as a part of the grid with elements of prime energy movers, power electronics converters, distributed energy storage systems and local loads, that can operate autonomously but also interacting with main grid. The functionalities expected for these small grids are: black start operation, frequency and voltage stability, active and reactive power flow control, active power filter capabilities, and storage energy management. This way, the energy can be generated and stored near the consumption points, increasing the reliability and reducing the losses produced by the large power lines.

The tutorial starts giving some examples of microgrid in the world. The tutorial is mainly focused on single and three-phase voltage source inverters. The modeling and control of these power electronics converters is presented. Concepts like frequency and voltage droop control are explained in detail, as well as the virtual impedance concept.

This tutorial also introduces the study of the hierarchical control of microgrids for DC and AC electrical systems. Secondary control issues are introduced to regulate frequency and amplitude voltage of the microgrid. Tertiary control issues, synchronization and grid interactivity between the grid and the microgrid are analyzed. Finally, the voltage unbalance and harmonic compensation by using decentralized controllers is presented.

SCHEDULE

1. Microgrid Overview
2. Control of Voltage Source Converters for Microgrids
3. Droop Control and Virtual Impedance
4. Distributed Uninterruptible Power Systems
5. Distributed energy storage systems
6. Hierarchical Control of Microgrids
7. Harmonics in Microgrids
8. Unbalances in Microgrids

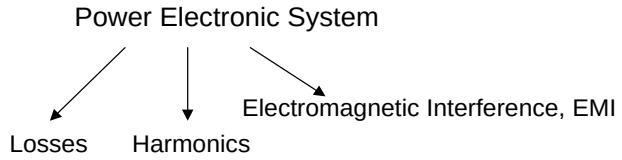
Tutorial 3: **Pulse Width Modulated Voltage Issues in Motor Drive Systems**
Monday, June 27, 14:00 - 18:30 Room 205
Firuz Zare, Queensland University of Technology, Australia

OUTLINE

The purpose of this tutorial is to address common-mode and shaft voltage issues in motor drive systems. Pulsed width modulated voltage waveform generated by a DC-AC converter with variable magnitude and frequency creates voltage stress (dv/dt) and common mode voltage. Due to capacitive coupling between different parts of an electric motor, the pulse width modulated voltage creates shaft voltage and leakage current. Fast switching transient improves the system performance, switching losses and system efficiency but a main drawback is the electromagnetic interference due to fast transient and parasitic components within the systems.

In order to reduce switching losses during power conversion, the semiconductor devices have been forced to turn on and off as fast as possible which are known to be substantial sources of electromagnetic noise. These electromagnetic emissions significantly cause additional costs. Therefore the electromagnetic compatibility of power electronic applications has become an engineering discipline with enormous economic importance.

This tutorial also presents a new approach to optimize size, cost and losses of a motor drive system by taking into account EMI issue as a main problem at the first development stage of a power electronic system. This is a challenging issue in modern power electronics, which requires engineers in mechanical, electrical, control and packaging disciplines consider it as a major problem. The purpose of this tutorial is to address fundamental concepts and principles of EMI and EMC in modern motor drive systems.



In most power electronics systems, switching losses, and thermal issues have been considered as major problems of power electronic systems and development engineers optimise the system using design tools with less attention on EMI as a main parameter. For example most of electrical energy is consumed by electric motors used in industries and home appliances; and motor drives have been widely used to minimise the energy consumption by controlling the speed of the electric motor used in different applications. Development engineers who design electric motors can optimise the electric motors if they consider EMI issues to minimise all capacitive coupling between the motor windings, stator and rotor which create significant conducted noise and shaft voltage.

Control engineers who develop software and algorithm to apply a modulation strategy consider dynamic performance of the system and total losses; different techniques and topologies with considering EMI issue can improve the system cost, size and performance.

Mechanical engineers analyse heat flow using finite element analysis in order to transfer heat generated by high power components in a system. It is a trade off between thermal and EMI issues in high power and high frequency systems where decreasing the separation between the conductors separated by insulators improves the thermal performance but increases the capacitive coupling and conducted emission noise.

These design engineers need to share their knowledge with EMC experts in order to understand better the problems and to minimise the source of noise at the development phases. This is a key point which improves the overall system performances.

SCHEDULE

1. Major EMI Problems in Power Electronic Systems

   In this section, several problems in motor drive systems will be discussed with theoretical analysis and simulation results which describe the main EMC problems in modern power electronic systems such as motor drives and high power converters. di/dt and dv/dt effects due to fast switching transients are analysed which may generate bearing current, shaft voltage, leakage current and over voltage. High power electronic motor drive systems have significant leakage current due to high capacitive coupling between the winding and the motor frame. This leakage current has a major source of conducted emission which requires bulky and expensive passive filters. Several active EMI filters will be discussed in order to suppress the leakage current and common-mode voltage.

2. High Frequency Model of Electric Motors

   Predicting the conducted emission in development phase is one of the major points to estimate cost and size of the EMI filter. A good high frequency model of a motor drive system is important to find the conducted emission noise level. This section describes several methods to model electric motors for EMI analysis.

3. Pulse Width Modulated Voltage Waveform and Common Mode Voltage

   In this section, common mode voltage will be calculated in term of active and zero vectors generated by a pulse width modulated voltage. The effects of zero vectors and capacitive couplings on shaft voltage will be discussed.

4. Techniques to Reduce Common Mode Voltage in Motor Drive Systems

   Several techniques will be discussed to reduce common mode voltage and shaft voltage. The side effects of these methods on quality, performance and cost of system will be addressed for different applications.

Technical program sessions

Track sessions

TT1: Building Automation and Smart Homes

Tuesday, June 28, 14:00 - 16:00 Room 231

Chair(s): Dietmar Bruckner

Non-haptic interaction system ▪ *Simon-Alexander Zerawa, Charlotte Roesener, Andreas Perner (Vienna University of Technology, Austria)*

Geodesic-based Human Posture Analysis by using a Single 3D TOF Camera ▪ *Giovanni Diraco, Alessandro Leone, Pietro Siciliano (Cnr-Imm, Italy)*

Sensitivity Analysis for the Design of Robust Nonlinear Control Strategies for Energy-Efficient Pressure Boosting Systems in Water Supply ▪ *Andreas Rauh, Christina Dittrich, Luise Senkel, Harald Aschemann (University of Rostock, Germany)*

Clustering Methods for Occupancy Prediction in Smart Home Control ▪ *Felix Iglesias Vazquez, Wolfgang Kastner (TU Vienna, Austria)*

Peak-Load Shaving in Smart Homes via Online Scheduling ▪ *Giuseppe Tommaso Costanzo, Jan Kheir, Guchuan Zhu (Montreal Polytechnique, Canada)*

Accessing KNX networks via BACnet/WS ▪ *Wolfgang Kastner, Stefan Szucsich (TU Vienna, Austria)*

TT2-1: Drives in Vehicular Applications

Tuesday, June 28, 14:00 - 16:00 Auditorium Min

Chair(s): Chandan Chakraborty, Wlodzimierz Koczara

A Concept of Induction Squirrel Cage Generator Application in Ship Electric Network ▪ *Maciej Kozak (Maritime University of Szczecin, Poland), Krzysztof Zawirski (Poznan University of Technology, Poland)*

Efficiency optimized control of induction machine drives for battery applications ▪ *Michael Bierhoff (Still GmbH, Germany)*

Research of Harmonic Spectrum of Currents in Traction Drive with PMSM ▪ *Radovan Dolecek, Jaroslav Novak, Ondrej Cerny, Zdenek Nemec (University of Pardubice, Czech Republic)*

Small Electric Vehicle Drive Control According to Maximal Efficiency Criteria ▪ *Petr Prochazka, Bohumil Klima, Pavel Vorel, Petr Hutak (Brno University of Technology, Czech Republic)*

A Study of Design Process of BLDC Motor for Aircraft Hybrid Drive ▪ *Piotr Bogusz, Mariusz Korkosz, Jan Prokop (Rzeszow University of Technology, Poland)*

Poles position identification of the permanent magnet motor by the PIPCRM combined with zero voltage vector ▪ *Janusz Wisniewski, Wlodzimierz Koczara (Warsaw University of Technology, Poland)*

TT2-2: Advanced Control Methods in Drives

Tuesday, June 28, 16:30 - 18:30 Auditorium Min

Chair(s): Michael Bierhoff, Krzysztof Szabat

Mixed Virtual Reference Feedback Tuning - Iterative Feedback Tuning: Method and Laboratory Assessment ▪ *Mircea-Bogdan Radac, Ramona-Bianca Grad, Radu-Emil Precup (Politehnica University of Timisoara, Romania), Emil M. Petriu (University of Ottawa, Canada), Stefan Preitl, Claudia-Adina Dragos (Politehnica University of Timisoara, Romania)*

Predictive Torque Control – A Solution for Mono Inverter-Dual Parallel PMSM System ▪ *Ngoc Linh Nguyen, Maurice Fadel, Ana M. Llor (Laplace - INPT, France)*

Active-Flux-Based, Vf-with-Stabilizing-Loops Versus Control of IPMSM Drives ▪ *Moldovan Ana-Adela (University Politehnica of Timisoara, Romania), Blaabjerg Frede (Aalborg University, Denmark), Boldea Ion (University Politehnica of Timisoara, Romania)*

Influence of the Discretization Method on the Integration Accuracy of Observers with Continuous Feedback ▪ *Mihai Comanescu (Penn State Altoona, USA)*

Generic criterion for tuning of adaptive digital PI current compensators of PMSM drives ▪ *Radoslaw Nalepa (ABB Sp. z o.o., Poland)*

TT2-3: Sensorless Control in Drives

Wednesday, June 29, 10:30 - 12:30 Auditorium Min

Chair(s): Henning Zoubek, Teresa Orlowska-Kowalska

Predictive Current Control Implementation in the Sensorless Induction Motor Drive ▪ *Jaroslaw Guzinski (Gdansk University of Technology, Poland), Haitham Abu-Rub (Texas A&M University at Qatar, Qatar)*

Robustness and Limitations of sensorless technique Based on Luenberger State Observer for Induction Motor Drives under Inverter Faults ▪ *Mohamed Trabelsi (LSIS, Ecole Centrale Marseille, France / C3S - Ecole Supérieure des Sciences et Techniques de Tunis, Tunisia), Mabrouk Jouili (Research Unity of Automatic Control - National Engineering School of Sfax, Tunisia), Mohamed Boussak (LSIS, Ecole Centrale Marseille, France), Yassine Koubaa (Research Unity of Automatic Control - National Engineering School of Sfax, Tunisia), Moncef Gossa (C3S - Ecole Supérieure des Sciences et Techniques de Tunis, Tunisia)*

Sensorless IPMSM drive with rotor position estimator based on analysis of phase current derivatives ▪ *Leszek Jarzebowicz (Gdansk University of Technology, Poland)*

Analysis of the Chosen Speed and Flux Estimators for Sensorless Induction Motor Drive ▪ *Teresa Orlowska-Kowalska, Grzegorz Tarchala, Mateusz Dybkowski (Wroclaw University of Technology, Poland)*

PMSM Sensorless Rotor Position Detection for all Speeds by Direct Flux Control ▪ *Peter Thiemann, Chawanakorn Mantala, Johannes Hoerdler, Daniel Groppe, Armin Trautmann (South Westphalia University of Applied Sciences, Germany) Rolf Strothmann (HighTec EDV-Systeme GmbH, Saarbruecken, Germany), Erping Zhou (University of Bolton, UK)*

Sensorless control of PMSM high dynamic drive at low speed range ▪ *Konrad Urbanski (Poznan University of Technology, Poland)*

TT2-4: Special Topics in Motor Drives

Wednesday, June 29, 14:00 - 16:00 Auditorium Min

Chair(s): Joseph Ojo, Zbigniew Krzeminski

High Power Factor Control for Inverter Output Power of IPM Motor Driven by Inverter System without Electrolytic Capacitor ▪ *Kazuya Inazuma, Kiyoshi Ohishi, Hitoshi Haga (Nagaoka University of Technology, Japan)*

A Scale Invariant Algorithm for the Automatic Diagnosis of Rotor Bar Failures in Induction Motors ▪ *Jose A. Antonino-Daviu (Universidad Politecnica De Valencia, Spain), Selin Aviyente, Elias Strangas (Michigan State University, USA), Martin Riera-Guasp (Universidad Politecnica De Valencia, Spain)*

Torques and Vehicle State: an Automotive Application of Unknown Inputs Observer ▪ *Mohamed Ouahi, Joanny Stephant, Dominique Meizel (XLIM, UMR CNRS 6172, Limoges University, France)*

Efficiency improvement for wind energy pumped storage systems ▪ *Andreea Forcos, Corneliu Marinescu (Transilvania University of Brasov, Romania), Remus Teodorescu (Institute of Energy Technology Aalborg, Denmark), Luminita Clotea (Transilvania University of Brasov, Romania)*

Direct Torque Control-Based Forced Dynamics Control of Induction Motors ▪ *Grzegorz Jarek, Michal Jelen, Kazimierz Gierlotka (Silesian University of Technology, Poland)*

Average-Value Modeling of Brushless DC Motors With Trapezoidal Back-EMF ▪ *Kamran Tabarraee, Jaishankar Iyer, Juri Jatskevich (University of British Columbia, Canada)*

TT2-5: SM and SRM Drives

Thursday, June 30, 10:30 - 12:30 Auditorium Min

Chair(s): Leila Parsa , Mickaël Hilairet

Modified TSF for the High Speed Switched Reluctance Motor ▪ *Dong-Hee Lee, So-Yeon Ahn, Jin-Woo Ahn (Kyungsung University, Korea), Jang-Mok Kim (Pusan National University, Korea)*

Speed Control Scheme of the High Speed 4/2 Switched Reluctance Motor ▪ *Dong-Hee Lee (Kyungsung University, Korea), Khoi Hyunh Khac Minh (TOSY ROBOTICS JSC, Viet Nam), Jin-Woo Ahn (Kyungsung University, Korea)*

Comparison of two Permanent Magnet Synchronous Drive position controllers ▪ *Joël Cathelin, Demba Diallo (Laboratoire de Génie Electrique de Paris, France)*

Hall-Sensor Signals Filtering for Improved Operation of Brushless DC Motors ▪ *Pooya Alaeinovin, Juri Jatskevich (University of British Columbia, Canada)*

Performance Analysis of Switched Reluctance Motor with Asymmetric Stator ▪ *Piotr Bogusz, Mariusz Korkosz, Jan Prokop (Rzeszow University of Technology, Poland)*

SVM-based Direct Thrust Control of Permanent Magnet Linear Synchronous Motor with Reduced Force Ripple ▪ *Ali Mohammadpour, Leila Parsa (Rensselaer Polytechnic Institute, USA)*

TT3-1: Factory Automation and Industrial Informatics

Tuesday, June 28, 14:00 - 16:00 Room 235

Chair(s): Luis Gomes, Aleksander Malinowski, Armando Walter Colombo

Fast Computation of arctangent Functions for Embedded Applications: A Comparative Analysis ▪ *Abhisek Ukil (ABB Corporate Research, Switzerland), Vishal Shah (ABB Corporate Research, India), Bernhard Deck (ABB Secheron S.A., Medium Voltage, Switzerland)*

A High-Performance CUDA-Based Computing Platform for Industrial Control Systems ▪ *Gianluca Cena, Marco Cereia, Stefano Scanzio, Adriano Valenzano, Claudio Zunino (Ieiit-Cnr, Italy)*

An Application Solution for PLC Redundancy in Distributed Control System ▪ *Nguyen Hung, Truong Chau (Ho Chi Minh City University of Technology, Viet Nam)*

The use of IEC 61131-3 to enhance PLC control and Matlab/Simulink process simulations ▪ *Andre Pereira, Celson Lima, Joao Martins (Fct/Unl, Portugal)*

Industrial Informatics Applications: Optimising Life Cycle Costs of an Underground Mining Longwall Conveyor ▪ *Benhur Balaba, Yousef Ibrahim (Monash University, Australia)*

Comparison between Traditional Neural Networks and Radial Basis Function Networks ▪ *Tiantian Xie, Hao Yu, Bogdan Wilamowski (Auburn Univerisity, USA)*

TT3-2: Factory Automation and Industrial Informatics

Tuesday, June 28, 16:30 - 18:30 Room 235

Chair(s): Luis Gomes, Aleksander Malinowski, Armando Walter Colombo

Prolonging WirelessHART Network Lifetime Using Data Aggregation ▪ *Jonas Neander, Tomas Lennvall, Mikael Gidlund (ABB AB, Corporate Research, Sweden)*

Towards safety and security critical communication systems based on SOA paradigm ▪ *Thomas Turek, Tayyaba Anees, Simon-Alexander Zerawa (Vienna University of Technology, Austria)*

Bandwidth-Efficient Admission Control for EDF-Based Wireless Industrial Communication ▪ *Emanuele Toscano, Lucia Lo Bello (University of Catania, Italy)*

Influence of Real Components Behavior on the Performance of Wireless Industrial Communication Systems ▪ *Stefano Vitturi, Lucia Seno (Cnr-Ieiit, Italy), Federico Tramarin (University of Padova, Italy)*

Geographic Routing Algorithm Implementation Using Simple MAC 802.15.4 ▪ *Tatiana G. Bonifacio, Rodrigo Palucci Pantoni, Dennis Brandao (University of Sao Paulo, Brazil)*

TT4-1: High Power Converters

Tuesday, June 28, 14:00 - 16:00 Auditorium Max

Chair(s): Chandan Chakraborty, Lech Grzesiak

A Hybrid Nine-level Inverter for IM Drive ▪ *Rajeevan P.P (CEDT, Indian Institute of Science, India), Sivakumar K. (IIT, Hyderabad, Andhrapradesh, India), Chintan Patel, Gopakumar K. (CEDT, Indian Institute of Science, Bangalore, India), Abu-Rub Haitham (Texas A&M, Qatar)*

Design and Simulation of a Modular Multi-level Converter for MVDC Application ▪ *Gopal Mondal, Roger Critchley, Fainan Hassan, Will Crookes (Alstom Research and Technology, United Kingdom)*

Power Devices Loading in Multilevel Converters for 10 MW Wind Turbines ▪ *Ke Ma, Frede Blaabjerg (Aalborg University, Denmark), Dehong Xu (Zhejiang University, China)*

New Flying Capacitor Multilevel Converter ▪ *G.P Adam, Bader Alajmi, K.H Ahmed, S.J Finney, B.W Williams (Strathclyde University, United Kingdom)*

Decentralized Control of a Cascaded H-Bridge Multilevel Converter ▪ *Wang Kong (Monash University, Australia), D. Grahame Holmes, Brendan McGrath (RMIT University, Australia)*

Low-frequency Components in the Switch Currents of Matrix Converter ▪ *Janina Rzasa (Rzeszow University of Technology, Poland)*

TT4-2: Converter applications

Tuesday, June 28, 16:30 - 18:30 Auditorium Max

Chair(s): K. Gopakumar, Hasan Komurcugil

Cascaded Inverters for electric vehicles: towards a better management of traction chain from the battery to the motor? ▪ *Benoit Sarrazin, Nicolas Rouger, Jean-Paul Ferrieux, Jean-Christophe Crébier (Grenoble Electrical Engineering Lab - CNRS / UJF Grenoble University 1 / Grenoble-INP, France)*

A New Matrix Converter Based Three Phase Brushless DC Motor Drive ▪ *Samitha Ransara Hewa Kokawalage, Udaya Kumara Madawala (University of Auckland, New Zealand)*

Ultracapacitor-based plug & play energy-recovery system for elevator retrofit ▪ *Estanis Oyarbide, Ivan Elizondo, Abelardo Martínez-Iturbe, Carlos Bernal, Javier Irisarri (Universidad de Zaragoza, Spain)*

Domestic Induction Cooking with A New Loads Multiplexing Topology Using Mechanical Switches ▪ *Magdy Saoudi (University Of Zaragoza, Spain), Diego Puyal, Daniel Antón (BSH electrodomésticos España S.A., Spain), Arturo Mediano (University Of Zaragoza, Spain)*

Evaluation of SiC JFETs and SiC Schottky Diodes for Wind Generation Systems ▪ *Marek Adamowicz, Sebastian Giziewski, Jedrzej Pietryka, Zbigniew Krzeminski, Mariusz Rutkowski (Gdansk University of Technology, Poland)*

TT4-3: High efficiency lighting

Wednesday, June 29, 10:30 - 12:30 Auditorium Max

Chair(s): Johann W. Kolar, João Luis Afonso

Single-Stage High-Power-Factor Dimmable Lighting System for Electrodeless Fluorescent Lamp ▪ *Ricardo Prado, Marcelo F. Silva, Jeferson Fraytag, Marson Schlittler, Marco Dalla Costa, Alysson Seidel, Natalia Chagas, Rafael Pinto (Ufsm - Ppgee - Gedre, Brazil)*

Electrodeless Fluorescent Lamps Model Operated at High Frequency ▪ *Ricardo Prado, Natalia Chagas, Marcelo Silva, Marson Schlittler, Jeferson Fraytag, Fabio Bisogno (Ufsm - Ppgee - Gedre, Brazil)*

Emergency Lamp Using High-Brightness LEDs ▪ *Rafael Adaime Pinto, Marcelo Rafael Cosetin, Murilo Cervi, Alexandre Campos, Ricardo Nederson do Prado (Federal University of Santa Maria, Brazil)*

An Experimental Comparison Between Different Technologies Arising for Public Lighting: LED Luminaires Replacing High Pressure Sodium Lamps ▪ *Pedro S. Almeida, Cláudio R. B. S. Rodrigues, Guilherme M. Soares, João M. Jorge, Danilo P. Pinto, Henrique A. C. Braga (Ufjf, Brazil)*

A Novel Method of Current Equalization in LED Strings Based on Simple Linear Circuit ▪ *Pedro S. Almeida, Cláudio R. B. S. Rodrigues, Guilherme M. Soares, João M. Jorge, Danilo P. Pinto, Henrique A. C. Braga (Ufjf, Brazil)*

A Single Stage Electronic Ballast Based on the 'Z' Source Inverter ▪ *Nimrod Vazquez, Alejandro Perea, Claudia Hernandez, Esli Vazquez (Instituto Tecnologico de Celaya, Mexico), Jaime Arau (Cenidet, Mexico)*

TT4-4: Control of Power Converters

Wednesday, June 29, 14:00 - 16:00 Auditorium Max

Chair(s): Grahame Holmes, Maurice Fadel

Control of a Quasi Resonant DC-link Soft Switching Inverter ▪ *Jayalakshmi Kedarisetti, Peter Mutschler (Technical University Darmstadt, Germany)*

Improving the Perturb and Observe maximum power point tracking by using Sliding Mode Control ▪ *Enrico Bianconi (Bitron SpA, Italy), Javier Calvente, Roberto Giral (Universitat Rovira i Virgili, Spain), Carlos Andres Ramos-Paja (Universidad Nacional de Colombia, Colombia), Giovanni Petrone, Giovanni Spagnuolo (University of Salerno, Italy), Massimo Vitelli (Second University of Naples, Italy)*

A fast current-based MPPT technique based on sliding mode control ▪ *Enrico Bianconi (Bitron SpA, Italy), Javier Calvente, Roberto Giral (Universitat Rovira i Virgili, Spain), Carlos Andres Ramos-Paja (Universidad Nacional de Colombia, Colombia), Giovanni Petrone, Giovanni Spagnuolo (University of Salerno, Italy), Massimo Vitelli (Second University of Naples, Italy)*

A Suitable Control Technique for Fault-Tolerant Converters in Distributed Generation ▪ *Carlo Cecati (University of L'Aquila, Italy), Fabio Genduso, Rosario Miceli, Giuseppe Ricco Galluzzo (University of Palermo, Italy)*

Fast Terminal Sliding Mode Control for Single-Phase UPS Inverters ▪ *Hasan Komurcugil (Eastern Mediterranean University, Turkey)*

TT4-5: Low Power / Energy Harvesting

Wednesday, June 29, 16:30 - 18:30 Auditorium Max

Chair(s): Maugars Philippe, Pinto Rafael Adaime

High-Voltage-Tolerant CMOS Level Shifters ▪ *Ahmed Emira (Cairo University, Egypt)*

A Low-Voltage Charge Pump for Micro Scale Thermal Energy Harvesting ▪ *Moataz AbdElFattah, Ahmed Mohieldin, Ahmed Emira (Cairo University, Egypt), Edgar Sanchez-Sinencio (Analog and Mixed-Signal Center, Texas A&M University, USA)*

Current-sensorless PFC Boost Converter with Preprogrammed Control Strategy ▪ *Antonio P. Finazzi, Luiz C. Freitas, Joao B. Vieira Jr, Ernane A. A. Coelho, Valdeir J. Farias, Luiz C. G. Freitas (Universidade Federal de Uberlândia, Brazil)*

Towards reduced threshold voltages for vertical power Mosfet transistors ▪ *Timothé Simonot, Hoa Xuan Nguyen, Nicolas Rouger, Jean-Christophe Crébier (Grenoble Electrical Engineering Lab - Grenoble University 1 / Grenoble-INP, France), Abdelhakim Bourennane (LAAS - CNRS - Université Paul Sabatier, France), Laurent Gerbaud (Grenoble Electrical Engineering Lab - Grenoble University 1 / Grenoble-INP,*

A Low Startup Voltage Charge Pump for Thermoelectric Energy Scavenging ▪ *Salwa Abdelaziz, Ahmed Emira, Ahmed G. Radwan, Ahmed N. Mohieldin, Ahmed M. Soliman, (Cairo University, Egypt)*

An Evaluation of 2-phase Charge Pump Topologies with Charge Transfer Switches for Green Mobile Technology ▪ *Yan Chiew Wong, Wei Zhou, Ahmed O. El-Rayis, Ahmet T. Erdogan, Tughrul Arslan (University of Edinburgh, United Kingdom)*

TT4-6: Modeling and Simulation

Thursday, June 30, 10:30 - 12:30 Auditorium Max

Chair(s): Edith Clavel, Istvan Nagy

Small-Signal Modeling of a DC-DC Class-E Piezoconverter based on Generalized Averaging Method ▪ *Raffael Engleitner, Fábio Ecke Bisogno, José Renes Pinheiro (Federal University of Santa Maria, Brazil), Matthias Radecker (Fraunhofer Institut IZM, Germany), Cassiano Rech, Leandro Michels (Federal University of Santa Maria, Brazil)*

Modeling and simulating the lightning phenomenon: aeronautic materials comparison in conducted and radiated modes ▪ *Ali Jazzar, Edith Clavel, Gérard Meunier, Benjamin Vincent, Enrico Vialardi (G2elab - INPG, France)*

High Frequency Modeling for CM Noise Coupling Path of Transformer Based on Transmission Line Theory ▪ *Peipei Meng, Henglin Chen, Junming Zhang, Zhaoming Qian, Hao Ma (Zhejiang University, China)*

Steady-State Analysis and Optimization of Bidirectional DC-DC Converters ▪ *Jianfu Fu, Olorunfemi Ojo (Tennessee Technological University, USA)*

Two Free Air Convection and Radiation Thermal Models for Planar Magnetic Components ▪ *Kien Lai-Dac, Yves Lembeye, Benoit Sarrazin (Grenoble Electrical Engineering Laboratory, France)*

Sensitivity Analysis in Dc-Dc Converter Optimal Design ▪ *Úrsula Ribes-Mallada, Ramon Leyva, Pedro Garcés (Universitat Rovira i Virgili, Spain)*

TT4-7: Power Converters for Power Quality

Thursday, June 30, 14:00 - 16:00 Auditorium Max

Chair(s): Frede Blaabjerg, Wlodzimierz Koczara, Dimitri Vinnikov

High Precision Compensation for High Power Hybrid Active Power Filter Based on Repetitive Control Algorithm ▪ *Lei Hong (ZheJiang University, China)*

Design of DC-bus Voltage Controller for Hybrid Active Power Filter Based on Pole-zero Placement ▪ *Lei Hong (ZheJiang University, China)*

Study on Shunt Active Power Filters with Coupled Inductors ▪ *Chao He, Chuan Xie, Guozhu Chen (Zhejiang University, China)*

A Modified Sheppard-Taylor Power Factor Corrector Operating in Discontinuous Capacitor Voltage Mode ▪ *Hadi Y. Kanaan (Saint-Joseph University, Lebanon), Kamal Al-Haddad (Ecole de Technologie Superieure, Canada)*

Single-Phase Series Active Conditioner for the Compensation of Voltage Harmonics, Sags, Swell and Flicker ▪ *Helder Carneiro, José Gabriel Pinto, João Luiz Afonso (University of Minho, Portugal)*

TT5-1: Human-Robot Interface

Tuesday, June 28, 14:00 - 16:00 Room 230

Chair(s): Yousef Ibrahim, Ju-Jang Lee

Absorption of Ambiguous Human Motion on Human Body Motion Interface ▪ *Sho Yokota (Setsunan University, Japan), Hiroshi Hashimoto (Advanced Institute of Industrial Technology, Japan), Daisuke Chugo (Kwansei Gakuin University, Japan), Yasuhiro Ohyama, Jinhua She (Tokyo University of Technology, Japan)*

Walking Trajectory Modification with Gyroscope for Biped Robot on Uneven Terrain ▪ *Takahiko Sato, Kouhei Ohnishi (Keio University, Japan)*

Force-distribution-based Evaluation of Product Design Suitable for Dynamically Dexterous Human Hand Manipulation ▪ *Akinori Sasaki (Tokyo Metropolitan Industrial Technology Research Institute, Japan), Hiroshi Hashimoto (Advanced Institute of Industrial Technology, Japan), Sho Yokota (Setsunan University, Japan), Yasuihiro Ohyama (Tokyo University of Technology, Japan), Chiharu Ishii (Hosei University, Japan)*

Running Experiments of Electric Wheelchair Powered by Natural Energies ▪ *Yoshihiko Takahashi, Syogo Matsuo (Kanagawa Institute of Technology, Japan)*

Performance Evaluation of a VR-based Hand and Finger Rehabilitation Program ▪ *Omar Andres Daud (University of Trento, Italy), Roberto Oboe (University of Padova, Italy), Michela Agostini, Andrea Turolla (I.R.C.C.S. San Camillo Venezia, Italy)*

TT5-2: Mechatronic System Design

Tuesday, June 28, 16:30 - 18:30 Room 230

Chair(s): Makoto Iwasaki, Krzysztof Lembke

Analytical control design for a biomimetic robotic fish ▪ *Jian-Xin Xu, Xue-Lei Niu (National University of Singapore, Singapore)*

Comparison between Heterogeneous Ant Colony Optimization Algorithm and Genetic Algorithm for Global Path Planning of Mobile Robot ▪ *Joon-Woo Lee, Byoung-Suk Choi (Kaist, Korea), Kyoung-Taik Park (Kimm, Korea), Ju-Jang Lee (Kaist, Korea)*

Improvement of Settling Performance by Mode Switching Control with Split Initial Value Compensation Based on Input Shaper ▪ *Yoshihiro Maeda, Masatake Wada, Makoto Iwasaki, Hiromu Hirai (Nagoya Institute of Technology, Japan)*

Model Predictive Attitude Control of an unmanned Tilt–Rotor aircraft ▪ *Christos Papachristos, Kostas Alexis, George Nikolakopoulos, Anthony Tzes (University of Patras, Greece)*

An Experimental Verification of ADRC Robustness on a Cross-coupled Aerodynamical System ▪ *Rafal Madonski, Przemyslaw Herman (Poznan University of Technology, Poland)*

Bio-nanorobotics in Nanotechnology: Structure and Potentials ▪ *H. R. Khataee (University of Putra, Malaysia), Yousef Ibrahim (Monash University, Australia), M.A. Teh Noranis (University of Putra, Malaysia)*

TT5-3: Mechatronic System Integration

Wednesday, June 29, 16:30 - 18:30 Room 230

Chair(s): Walter Schumacher, Rafal Madonski

Fast Locking of PLLs using Fuzzy Gain Scheduling ▪ *Ahmet Kuzu, Ozgur Songuler (Tubitak Bilgem Bte, Turkey), Seta Bogosyan (Univiversity of Alaska Fairbanks, USA), Metin Gokasan (Istanbul Technical University, Turkey)*

Object Tracking-by-Detection under Cluttered Environments Based on a Discriminative Approach ▪ *Ren C. Luo, Ching C. Kao (National Taiwan University, Taiwan)*

Visual Predictive Control Architecture based on Image Moments for Manipulator Robots ▪ *Cosmin Copot, Adrian Burlacu, Corneliu Lazar (Gheorghe Asachi Technical University of Iasi, Romania)*

RoboMote: Mobile Autonomous Hardware Platform for Wireless Ad-hoc Sensor Networks ▪ *Krzysztof Lembke, Lukasz Kietlinski, Marcin Golanski, Radoslaw Schoeneich (Warsaw University of Technology, Poland)*

Low Latency WI-FI Real-Time Protocol for Agricultural Machines Synchronization Using Linux RT Kernel ▪ *Alfredo Revenaz (University of Ferrara, Italy), Massimiliano Ruggeri (Imamoter-Cnr, Italy), Velio Tralli (University of Ferrara, Italy)*

Throughput limits of two 802.15.4 wireless network applications for signal acquisition ▪ *Joel Alves, André Catarino, Helder Carvalho, João Monteiro, Ana Rocha (University of Minho, Portugal)*

TT6-1: Power conditioning

Wednesday, June 29, 10:30 - 12:30 Room 204

Chair(s): Wlodzimierz Koczara, Kamal Al-Haddad

Super Capacitor Applications for Renewable Energy Generation and Control in Smart Grids ▪ *Yonghua Cheng (VITO - Flemish Institute for Technological Research, Belgium)*

Single-Phase Power Quality Conditioners with Series-Parallel Filtering Capabilities ▪ *Sergio da Silva (Federal Technological University of Paraná - UTFPR, Brazil), Rodrigo Barriviera (Federal Institute of Paraná - IFPR, Brazil), Rodrigo Modesto, Mauricio Kaster, Alessandro Goedtel (Federal Technological University of Paraná - UTFPR, Brazil)*

Improvement of Dynamic Behavior and System Stability by Using STATCOM ▪ *Ghazanfar Shahgholian, Mehdi Mahdavian, Afshin Etesami, Sepehr Moalem, Masoud Jabbari (Islamic Azad University, Iran)*

Modeling and Dynamic Analysis of a STATCOM for System Damping Enhancement ▪ *Masoud Jabbari, Ghazanfar Shahgholian, Mehdi Mahdavian, Ehsan Attarpour, Ali Leilaeyoun (Islamic Azad University, Iran)*

FACTS for Grid Integration of Dispersed Generation and Heavy Industrial Loads ▪ *Rolf Grünbaum (ABB AB, Sweden)*

Effect of Static Shunt Compensation on Power System Dynamic Performance ▪ *Mehdi Mahdavian, Ghazanfar Shahgholian, Pegah Shafaghi, Masoud Jabbari, Mohammad Bayati-Poudeh (Islamic Azad University, Iran)*

TT6-2: Grid interfacing and MPPT 1

Wednesday, June 29, 14:00 - 16:00 Room 204

Chair(s): Teresa Orlowska-Kowalska, Marek Jasinski, Marcian Cirstea

A Novel Implementation of a Maximum Power Point Tracking System with Digital Control ▪ *Dorin Petreus, Stefan Daraban (Technical University of Cluj-Napoca, Romania), Marcian Cirstea (Anglia Ruskin University, Cambridge, United Kingdom), Toma Patarau, Radu Etz (Technical University of Cluj-Napoca, Romania)*

Single-phase Current-Source-Boost Inverter for Renewable Energy Sources ▪ *Leonardo Sampaio, Moacyr Brito (São Paulo State University, Brazil), Luigi Junior (Ufms, Brazil), Guilherme Melo, Carlos Canesin (São Paulo State University, Brazil)*

Evaluation of MPPT Techniques for Photovoltaic Applications ▪ *Moacyr Brito (São Paulo State University, Brazil), Luigi Junior (Ufms, Brazil), Leonardo Sampaio, Carlos Canesin (São Paulo State University, Brazil)*

Low Power Wind Generation System based on Variable Speed Permanent Magnet Synchronous Generators ▪ *Oscar Carranza Castillo, Emilio Figueres Amoros, Gabriel Garcera Sanfeliu, Ruben Ortega Gonzalez, David Velasco de la Fuente (Universidad Politecnica de Valencia, Spain)*

Third Harmonic Injected Binary Hybrid Multilevel Inverter for Grid Connected Photovoltaic System ▪ *Sumit Chattopadhyay, Chandan Chakraborty (IIT Kharagpur, India)*

Design of Small Wind Turbine with Maximum Power Point Tracking Algorithm ▪ *M. Rolak, R. Kot, M. Malinowski (Warsaw University of Technology, Poland), Z. Goryca (Technical University of Radom, Poland), J.T. Szuster (Warsaw University of Technology, Poland)*

TT6-3: Grid interfacing and MPPT 2

Thursday, June 30, 10:30 - 12:30 Room 204

Chair(s): Marian P. Kazmierkowski, Jan T. Bialasiewicz

Realization of Modified Ripple-based MPPT in a Single-Phase Single-Stage Grid-Connected Photovoltaic System ▪ *Robert Stala, Krzysztof Kóska, Lukasz Stawiarski (AGH-University of Science and Technology, Poland)*

LPV Model for PV Cells and Fractional Control of DC/DC Converter for Photovoltaic Systems ▪ *Ruben Martinez, Yolanda Bolea, Antoni Grau, Herminio Martinez (Technical Univ of Catalonia, Spain)*

Single Stage Converters for Low Power Stand- Alone and Grid-Connected PV Systems ▪ *Luigi Junior (Ufms, Brazil), Moacyr Brito, Leonardo Sampaio, Carlos Canesin (São Paulo State University, Brazil)*

Comparative Analysis of Synchronous Rectification Boost and Diode Rectification Boost Converter for DMPPT Applications ▪ *Giorgio Graditi, Giovanna Adinolfi (ENEA - Italian National agency for new technologies, energy and sustainable economic development, Italy), Nicola Femia (DIIIE Università di Salerno, Italy), Massimo Vitelli (DII Seconda Università di Napoli, Italy)*

Control algorithm of a DC/AC converter applied in a small wind turbine ▪ *Pawel Mlodzikowski, Adam Milczarek, Mariusz Malinowski (Warsaw University of Technology, Poland)*

Coordinated Control of Grid-Connected Three-Level NPC Converter under Distorted Grid Voltage ▪ *Krzysztof Rafal, Malgorzata Bobrowska-Rafal, Szymon Piasecki, Marek Jasinski (Warsaw University of Technology, Poland)*

TT6-4: Power systems control

Thursday, June 30, 14:00 - 16:00 Room 204

Chair(s): Chandan Chakraborty, Marco Lissere, Pedro Rodriguez

Employment of Programmable Controllers, Control Systems and Service Oriented Architecture for the Integration of Distributed Generators in the Grid ▪ *Samer Jaloudi, Andreas Schmelter, Egon Ortjohann, Worpong Sinsukthavorn, Paramet Wirasanti (South Westphalia University of Applied Sciences, Germany), Danny Morton (University of Bolton, Germany)*

Clustered Hierarchical Control Strategy for Future Power System ▪ *Egon Ortjohann, Worpong Sinsukthavorn, Max Lingemann, Samer Jaloudi, Paramet Wirasanti (South Westphalia University of Applied Sciences, Germany), Danny Morton (University of Bolton, United Kingdom)*

Fault Location in Radial Distribution Lines Using Travelling Waves and Network Theory ▪ *Ajendra Dwivedi, Xinghuo Yu (RMIT University, Australia)*

Multi-Cell Battery Emulator for Advanced Battery Management System Benchmarking ▪ *Alexandre Collet, Jean-Christophe Crebier, Alexandre Chureau (Grenoble Institute of Technology, France)*

The Impact of Currents Harmonics over The Voltage Transformers from a Power Group ▪ *Petre-Marian Nicolae, Ileana-Diana Nicolae (University of Craiova, Romania)*

Switching Reconfiguration of a Solar Photovoltaic Converter Considering Shadow Conditions ▪ *Afranio Vilela, Joao de Oliveira, Gabriel Ribeiro, Alexandre Brandao, Heverton Pereira (Federal University of Vicosa, Brazil)*

TT7: Sensors, Actuators and System Integration

Wednesday, June 29, 16:30 -18:30 Room 235

Chair(s): Kiyoshi Ohishi, Toshiyuki Murakami

On increasing the power available to an intrinsically safe wireless HART adapter ▪ *Yannick Maret, Daniel Schrag, Richard Bloch (ABB Corporate Research, Switzerland)*

A Dimmable Power supply unit for testing LED lamps built around a dedicated Integrated Circuit ▪ *Frederic Mercier, Nori Hamza, Christophe Delcourt, Philippe Maugars, Stefan Bara (NXP Semiconductors, France), Winston Langeslag, Victor Zwanenberg, Maikel Sturkenboom (NXP Semiconductors, Netherlands), Richard Grisel (Universite de ROUEN (CNRS), France)*

An electronic tongue for monitoring drinking waters using a fuzzy ARTMAP neural network implemented on a microcontroller ▪ *Eduardo Garcia-Breijo (Universidad Politécnica de Valencia, Spain), John Atkinson (University of Southampton, United Kingdom), Jose Garrigues, Luis Gil, Javier Ibañez (Universidad Politécnica de Valencia, Spain), Monika Glanc (University of Southampton, United Kingdom), Cristian Olguin (Universidad Politécnica de Valencia, Spain)*

Resonant piezoelectric force sensor using two flexional differential modes ▪ *Julien Yong, Jean-François Rouchon (LAPLACE, France)*

FPGA Implementation of a Signal Synthesizer for Driving a High-power Electrostatic Motor ▪ *Fumitaka Kimura, Akio Yamamoto, Toshiro Higuchi (University of Tokyo, Japan)*

Calibration And Test Of Difar Sonobuoys ▪ *Ahmet Kuzu, Uveys Danis, Engin Kurt, Engin Karabulut, Demet Sahinkaya (Tubitak Bilgem Bte, Turkey), Eyup Bilgic (Tubitak Ume, Turkey), Ahmet Kaplaner, Serdar Birecik (Tubitak Bilgem Bte, Turkey)*

TT8-1: Signal Processing and Computational Intelligence

Tuesday, June 28, 16:30 - 18:30 Room 204

Chair(s): Grahame Holmes, Bruno Sareni

Visual Odometry and map fusion for GPS navigation assistance ▪ *Ignacio Parra, Miguel A. Sotelo, David F. Llorca, Carlos Fernández, Ángel Llamazares, Noelia Hernández, Iván García (University of Alcalá, Spain)*

Action planning for autonomous agents based on neuropsychoanalytical concepts ▪ *Andreas Perner, Charlotte Roesener, Klaus Doblhammer, Dietmar Bruckner (Vienna University of Technology, Austria)*

Power Stages and Microcontroller Based Timing of a Multi-Function Power Converter for Welding ▪ *Péter Forgács (FORTRANS Ltd., Hungary), József Feketű (C&Ari, Hungary), Miklós Horváth (DiFiLTON-ARC Ltd, Hungary)*

Incremental Pattern Characterization Learning and Forecasting for Electricity Consumption using Smart Meters ▪ *Daswin De Silva, Xinghuo Yu (RMIT University, Australia), Damminda Alahakoon (Monash University, Australia), Grahame Holmes (RMIT University, Australia)*

Beacon Scheduling for Efficient Localization of a Mobile Robot ▪ *Jaehyun Park, Hyun Lee, Yoseop Hwang, Seoyoung Hwang, Jangmyung Lee (Pusan National University, Korea)*

Runtime Reconfigurable MPSoC Architecture for Control Drive System ▪ *Hedi Abdelkrim, Slim Ben Othman, Ahmed Karim Ben Salem, Slim Ben Saoud (Lecap, Tunisia)*

TT8-2: Signal Processing and Computational Intelligence

Thursday, June 30, 10:30 - 12:30 Room 205

Chair(s): Ren C. Luo

Gender Classification Based on Multi-Classifiers Fusion for Human-Robot Interaction ▪ *Ren C Luo, Tzu TA Lin, Ming Chieh Tsai (National Taiwan University, Taiwan)*

Three Ratio Configuration Methods for Multiple Description Correlating Transform Coding ▪ *Daichi Saitoh, Takahiro Yakoh (Keio University, Japan)*

Bayesian Analysis of Direct Sequence Spread Spectrum Unmanned Aerial Vehicle PPM Control Signal Two-Level Detection ▪ *Branislav M. Todorovic (RT-RK d.o.o., Serbia), Vladimir D. Orlic (IMTEL Komunikacije A.D., Serbia)*

Hierarchical Bayesian Classifiers Optimized towards Handwritten Digit Recognition ▪ *Olivier Pauplin, Jianmin Jiang (University of Bradford, United Kingdom)*

Using a SSVEP-BCI to Command a Robotic Wheelchair ▪ *Sandra Muller, Teodiano Bastos-Filho, Mario Sarcinelli-Filho (Universidade Federal do Espirito Santo, Brazil)*

A cost function analysis of a blind phase acquisition method ▪ *Grzegorz Dziwoki (Silesian University of Technology, Poland)*

Special sessions

SS02: Microgrids

Wednesday, June 29, 16:30 - 18:30 Room 204

Chair(s): Josep M. Guerrero

Experimental Evaluation of Voltage Unbalance Compensation in an Islanded Microgrid ▪ *Mehdi Savaghebi (Islamic Azad University, Iran)*

Sensorless control for small wind turbines with permanent magnet synchronous generator ▪ *Ioan Serban, Corneliu Marinescu (Transilvania University Of Brasov, Romania)*

Reconfigurable control scheme for a microinverter working in both grid connected and island mode ▪ *Cesar Trujillo, David Velasco, Gabriel Garcera, Emilio Figueres, Ruben Ortega (Universidad Politecnica de Valencia, Spain)*

Photovoltaic Power Management System with Grid Connected and Islanded Operation ▪ *David Velasco, Cesar Trujillo, Gabriel Garcera, Emilio Figueres, Oscar Carranza (Universidad Politecnica de Valencia, Spain)*

Control of Line Interactive UPS Systems in a Microgrid ▪ *M.A. Abusara (University of Exeter, United Kingdom), S.M. Sharkh (University of Southampton, United Kingdom)*

DFIG based Power System Supplying Nonlinear Load ▪ *Grzegorz Iwanski (Warsaw University of Technology, Poland)*

SS04: Industrial Applications of FPGAs and Embedded Systems

Wednesday, June 29, 16:30 - 18:30 Room 234

Chair(s): Luis Gomes, Juan Jose Rodriguez Andina

Hardware-in-the-Loop Simulation of FPGA Embedded Processor Based Controls for Power Electronics ▪ *Oscar Jimenez, Isidro Urriza, Luis A. Barragán, Denis Navarro, José I. Artigas, Oscar Lucia (Universidad de Zaragoza, Spain)*

Digital Implementation of Hierarchical Piecewise-Affine Controllers ▪ *Iluminada Baturone, Macarena C. Martínez-Rodríguez (University of Seville, Spain), Piedad Brox (Imse-Csic, Spain), Andrés Gersnoviez (University of Cordoba, Spain), Santiago Sánchez-Solano (Imse-Csic, Spain)*

Automatic Generation of Graphical User Interfaces for VHDL based Controllers ▪ *Filipe Moutinho (Fct/Unl & Uninova, Portugal), Fernando Pereira (Fct/Unl & Isel, Portugal), Luís Gomes (Fct/Unl & Uninova, Portugal)*

Intra- and inter-circuit network for Petri Nets based components ▪ *Ricardo Ferreira (Universidade Nova de Lisboa - FCT, Portugal), Aniko Costa, Luis Gomes (Universidade Nova de Lisboa-FCT and UNINOVA-CTS, Portugal)*

FPGA-Based Measurement of Melt Pool Size in Laser Cladding Systems ▪ *Pablo Colodron, Jose Farina, Juan J. Rodriguez-Andina (University of Vigo, Spain), Felix Vidal, Jose L. Mato, M. Angeles Montealegre (Aimen, Spain)*

Improving Timing Predictability in UGV Control Systems through FPGA Implementation ▪ *Lucia Costas, Pablo Colodron (University of Vigo, Spain), Unnati Ojha (North Carolina State University, USA), Juan J. Rodriguez-Andina, Jose Farina (University of Vigo, Spain), Mo-Yuen Chow (North Carolina State University, USA)*

SS05-1: FPGA for Industrial Control Systems

Tuesday, June 28, 14:00 - 16:00 Room 234

Chair(s): Karel Jezernik, Eric Monmasson

Application of Hybrid System Theory to Switching Control of a Three-Phase Inverter ▪ *Karel Jezernik, Robert Horvat (University of Maribor, Slovenia)*

FPGA Based Control of Quasi Resonant DC-link Inverter and Induction Motor Drive ▪ *Jayalakshmi Kedarisetti, Peter Mutschler (Technical University Darmstadt, Germany)*

VSI load online state-space estimator with FPGA based modulator-sampler ▪ *Bjarte Hoff, Waldemar Sulkowski, Trond Østrem (Narvik University College, Norway)*

FPGA Implementation of a Synchronous Motor Real-Time Emulator based on Delta Operator ▪ *Mohamed Dagbagi (Enit - Lse, Tunisia), Lahoucine Idkhajine, Eric Monmasson (Ucp - Iup Geii, France), Lotfi Charaabi, Ilhem Slama-Belkhodja (Enit - Lse, Tunisia)*

FPGA-based fault tolerant scheme with reduced extra-sensor number for WECS with DFIG ▪ *Mahmoud Shahbazi (GREEN, Université de Nancy, France / CEPSMC, Sharif University of Technology, Iran), Arnaud Gaillard (Université de Nancy, France), Philippe Poure (LIEN, Université de Nancy, France), Mohammad Reza Zolghadri (CEPSMC, Sharif University of Technology, Iran)*

Comparison of DSP and FPGA Realization of Neural Speed Estimator for 2-mass System ▪ *Marcin Kaminski, Teresa Orlowska-Kowalska (Politechnika Wroclawska, Poland)*

SS05-2: FPGA for Industrial Control Systems

Tuesday, June 28, 16:30 - 18:30 Room 234

Chair(s): Eric Monmasson

Design and Implementation of the Digital Controller for Boost Converter based on FPGA ▪ *Bo Li, Shuibao Guo, Xuefang Lin-Shi, Bruno Allard (Universite De Lyon, France)*

Discrete-time One Cycle Control technique applied in PFC boost converter by FPGA ▪ *Tiago K. Jappe, Samir A. Mussa (Federal University of Santa Catarina, Brazil)*

FPGA based sliding mode control for high frequency SEPIC ▪ *Nan Li (Ampere, France)*

FPGA implementation of fixed and variable frequency ADALINE schemes for grid-connected VSI synchronization ▪ *Alben Cardenas, Cristina Guzman, Kodjo Agbossou (Universite du Quebec a Trois-Rivieres, Canada)*

Fault Containment in a Reconfigurable Multi-Processor System-on-a-Chip ▪ *Roman Obermaisser (University of Siegen, Germany), Oliver Hoeftberger (Vienna University of Technology, Austria)*

SS06: Power Quality and Demand Control in Distributed Energy Systems with Renewables

Wednesday, June 29, 10:30 - 12:30 Room 205

Chair(s): Josep Balcells, Jan T. Bialasiewicz

SVC model for voltage control of a microgrid ▪ *Paco Bogónez-Franco, Josep Balcells, Oriol Junyent, Josep Jordà (Universitat Politècnica de Catalunya, Spain)*

Per-Phase Vector (dq) Controlled Three-phase Grid-Forming Inverter for Stand-Alone Systems ▪ *Nayeem Ahmed Ninad, Luiz Lopes (Concordia University, Canada)*

A Simple Control Method for PWM Rectifiers and Shunt Active Power Filters ▪ *S. R. Naidu (Ufcg, Brazil), D. A. Fernandes (Ifrn, Brazil), K. P. Medeiros (Ufcg, Brazil)*

Dynamic Modeling and Control of an AC--Link Dynamic Voltage Restorer ▪ *Pedro M Garcia-Vite (CINVESTAV-Gdl, Mexico), Fernando Mancilla-David (University of Colorado Denver, USA), Juan M Ramirez (CINVESTAV-Gdl, Mexico)*

Immunity of power line communications (PLC) in disturbed networks ▪ *Bernat Vallbé, Josep Balcells, Paco Bogónez-Franco (Tieg-Upc, Spain), Jorge Mata (Entel-Upc, Spain), Javier Gago (Tieg-Upc, Spain)*

Series Compensation to Mitigate Harmonics and Voltage Sags/Swells in Distributed Generation Based on Symmetrical Components Estimation ▪ *R. S. Bajpai, Rajesh Gupta (M. N. National Institute of Technology, India)*

SS07: Electric Drives for Hybrid and Plug-in Hybrid Electric Vehicles

Wednesday, June 29, 14:00 - 16:00 Room 234

Chair(s): Mahesh Krishnamurty

Mobi_System: A Personal Travel Assistance for Electrical Vehicles in Smart Cities ▪ *Joao Ferreira (Isel, Portugal), Joao Afonso (Univ Minho, Portugal)*

Power electronics and control of two-voltage-level flywheel based all-electric driveline ▪ *Janaína Goncalves de Oliveira, Hans Bernhoff (Uppsala University, Sweden)*

Small Electric Car with Battery and Fuel Cells ▪ *Dalibor Cervinka, Petr Prochazka, Ivo Pazdera, Vladimir Minarik (Brno University of Technology, Czech Republic)*

The Energy Storage System based on the Supercapacitors ▪ *Pavel Drabek, Lubos Streit (West Bohemia University in Plzen, Czech Republic)*

SS08: Distributed State Estimation and Fault Diagnosis for Distribution Management Systems in Active Networks and Smart Grids

Tuesday, June 28, 14:00 - 16:00 Room 204

Chair(s): Pierluigi Siano

Distributed state estimation for condition monitoring of nonlinear electric power systems ▪ *Gerasimos Rigatos (Industrial Systems Institute, Greece), Pierluigi Siano (University of Salerno, Italy)*

A Fuzzy Controller for Improving Fault Ride-Through Capability of Wind TurbinesA Fuzzy Controller for Improving Fault Ride-Through Capability of Wind Turbines ▪ *Pierluigi Siano, Antonio Piccolo, Geev Mokryani, Vito Calderaro (University of Salerno, Italy)*

Distributed Coordination-by-Constraint Strategies in Networked Multi-Area Power Systems ▪ *Alessandro Casavola, Giuseppe Franzè (Università della Calabria, Italy), Emanuele Garone (Université Libre de Bruxelles, Belgium), Francesco Tedesco (Università della Calabria, Italy)*

Development of Distributed State Estimation Methods to Enable Smart Distribution Management Systems ▪ *Nazia Nusrat, Malcolm Irving, Gareth Taylor (Brunel University, United Kingdom)*

A Decentralized Architecture for Voltage Regulation in Smart Grids ▪ *Vincenzo Loia (University of Salerno, Italy), Alfredo Vaccaro (University of Sannio, Italy)*

SS10: Service-Oriented Architectures in Process Monitoring and Control

Wednesday, June 29, 16:30 - 18:30 Room 231

Chair(s): Thomas Bangemann, Stamatis Karnouskos, Armando Walter Colombo, Jerker Delsing

Efficient Structured Data Processing for Web Service Enabled Shop Floor Devices ▪ *Rumen Kyusakov, Jens Eliasson, Jerker Delsing (Lulea University of Technology, Sweden)*

Real time device level Service-Oriented Architectures ▪ *Francois Jammes (Schneider Electric, France)*

Roadmap for SOA event processing and service execution in Real-Time using Timber ▪ *Pawel Pietrzak, Rumen Kyusakov, Jens Eliasson, Per Lindgren (Ltu, Sweden)*

Distributed Automation System supports Process Monitoring and Control ▪ *Matthias Riedl, Holger Zipper, Thomas Bangemann, Marco Meier (ifak Institut f. Automation und Kommunikation e.V. Magdeburg, Germany)*

SS11: Smart Devices for Renewable Energy Systems

Wednesday, June 29, 14:00 - 16:00 Room 205

Chair(s): Carlo Cecati, Pierluigi Siano

Stability analysis of grid-connected PV systems based on impedance frequency response ▪ *Jose Raul Rodriguez Villarreal, Domingo Biel, Francesc Guinjoan (Universidad Politécnica de Cataluña, Spain)*

A Three Port Converter for Renewable Energy Applications ▪ *Nimrod Vazquez, Carlos Sanchez, Claudia Hernandez, Esli Vazquez, Raul Lesso (Instituto Tecnologico de Celaya, Mexico)*

What is the best dc/dc converter for an AC module? Experimental analysis of two interesting solutions ▪ *Emilio Mamarelis, Giovanni Petrone (University of Salerno, Italy), Benjamin Sahan, Georgios Lempidis (University of Kassel, Germany), Giovanni Spagnuolo (University of Salerno, Italy), Peter Zacharias (University of Kassel, Germany)*

Towards an ontology framework for intelligent smart home management and energy saving ▪ *Marco Grassi, Michele Nucci, Francesco Piazza (Università Politecnica delle Marche, Italy)*

Comparison of Central vs Distributed Inverters: Application to Photovoltaic Systems ▪ *Jose Antonio Villarejo, Angel Molina-Garcia, Esther De Jodar (Technical University of Cartagena, Spain)*

SS12: Agent Technology in Manufacturing Automation

Wednesday, June 29, 10:30 - 12:30 Room 230

Chair(s): Paulo Leitao

Dynamic Skills Composition and Execution in a Multi-agent Manufacturing System ▪ *Pedro Deusdado, Gonçalo Cândido, José Barata (Universidade Nova de Lisboa, Portugal)*

Considering Multi-Evaluation Perspectives in an Agent-Based FMS Scheduling Approach ▪ *Ghada Abaza (Stuttgart University, Germany), Iman Badr (Helwan University, Egypt), Peter Goehner (Stuttgart University, Germany), Sabina Jeschke (RWTH Aachen University, Germany)*

An approach for temporal myopia reduction in heterarchical control architectures ▪ *Gabriel Zambrano, Cyrille Pach (Tempo Lab, France), Nassima Aissani (Oran University, Algeria), Thierry Berger, Damien Trentresaux (Tempo Lab, France)*

IT Support of Mechatronic Networks: A Brief Survey ▪ *Luis Ribeiro, Goncalo Candido, José Barata (Cts - Uninova, Portugal), Steffen Schuetz, Andreas Hofmann (Iai - Kit, Germany)*

Combining Adaptation and Optimization in Bio-inspired Multi-Agent Manufacturing Systems ▪ *José Barbosa, Paulo Leitão, Ana Pereira (Polytechnic Institute of Bragança, Portugal)*

SS13: Predictive Control of Power Converters and Drives

Thursday, June 30, 14:00 - 16:00 Room 205

Chair(s): Sergio Vazquez, Patricio Cortes, Leopoldo Garcia Franquelo, Marcin T. Cychowski

Geometrical Approach of Current Predictive Control for Four-Leg Converters ▪ *Aziz Choubail Ziani, Ana Maria Llor, Maurice Fadel (LAPLACE, France)*

Predictive Control of DC-link Voltage in an Active-Front-End Rectifier ▪ *Marcelo A. Perez, Ricardo Lizana, Jose Rodriguez (Universidad Tecnica Federico Santa Maria, Chile)*

Predictive Current Control with Reduction of Switching Frequency for Three Phase Voltage Source Inverters ▪ *Patricio Cortes, Luna Vattuone, Jose Rodriguez (Universidad Tecnica Federico Santa Maria, Chile)*

Predictive Torque Control of Interior Permanent Magnets Synchronous Motors in Stator Coordinates ▪ *Vanja Ambrozic, Klemen Drobnic, Mitja Nemec (University of Ljubljana, Slovenia)*

Model Predictive Control of a VSI with Long Prediction Horizon ▪ *Sergio Vazquez, Carlos Montero, Carlos Bordons, Leopoldo Franquelo (University of Seville, Spain)*

SS14-1: Multilevel Converters

Wednesday, June 29, 10:30 - 12:30 Room 235

Chair(s): Leopoldo G. Franquelo, Jose I. Leon

Diagnosis Strategies and Reconfiguration of a 5-Level Double-Boost PFC with Fault-Tolerant Capability ▪ *Thi Thuy Linh Pham, Frédéric Richardeau, Guillaume Gateau (Laplace, France)*

Control of the DC Link Capacitor Voltage on A New Four-Level SMC Based Topology ▪ *Alexandre Leredde, Guillaume Gateau (LAPLACE, France)*

Averaged Model Of The 31-Level Packed U Cells Converter ▪ *Youssef Ounejjar, Kamal Al-Haddad (Ecole de Technologie Superieure, Canada), Abdulrahman Alolah (College of Engineering, Saudi Arabia)*

Compact Energy Efficient Switched-Capacitor Multilevel DC-DC Converters for Interfacing DC-Busses with Common Ground ▪ *Michael Njoroge Gitau, Cedrick Lomami Kala-Konga (University of Pretoria, South Africa)*

Cascaded H-Bridge Multilevel Converter Multistring Topology for Large Scale Photovoltaic Systems ▪ *Sebastian Rivera (Universidad Tecnica Federico Santa Maria, Chile), Samir Kouro, Bin Wu (Ryerson University, Canada), Jose I. Leon (University of Seville, Spain), Jose Rodriguez (Universidad Tecnica Federico Santa Maria, Chile), Leopoldo G. Franquelo (University of Seville, Spain)*

SS14-2: Multilevel Converters

Wednesday, June 29, 14:00 - 16:00 Room 235

Chair(s): Leopoldo G. Franquelo, Jose I. Leon

Multi-level space-vector PWM algorithm for seven-phase open-end winding drives ▪ *Nandor Bodo, Martin Jones, Emil Levi (Liverpool John Moores University, United Kingdom)*

Simple Modulator with Voltage Balancing Control for the Hybrid Five-Level Flying-Capacitor Based ANPC Converter ▪ *Jose I. Leon, Leopoldo G. Franquelo (University of Seville, Spain), Samir Kouro, Bin Wu (Ryerson University, Canada), Sergio Vazquez (University of Seville, Spain)*

Modulation Strategy for Minimizing Commutations and Capacitor Voltage Balancing in Symmetrical Cascaded Multilevel Converters ▪ *Marcos Balduino Alvarenga (Instituto Federal de Educação, Ciência*

e Tecnologia do Tocantins - IFTO, Brazil), José Antenor Pomilio (Universidade Estadual de Campinas - Unic, Brazil)

Generalized Modeling and Simulation of an Modular Multilevel Converter ▪ *Marcelo A. Perez, Jose Rodriguez (Universidad Tecnica Federico Santa Maria, Chile)*

Modeling the Effect of Parasitic Capacitances on the Dead-Time Distortion in Multilevel NPC Inverters ▪ *Krzysztof Szwarc, Artur Cichowski, Janusz Nieznanski, Pawel Szczepankowski (Gdansk University of Technology, Poland)*

SS15: Identification and Control Concepts for Multi-mass Systems

Wednesday, June 29, 14:00 - 16:00 Room 231

Chair(s): Teresa Orlowska-Kowalska

Application of the MPC to the Robust Control of the Two-Mass Drive System ▪ *Krzysztof Szabat, Piotr Serkies (Wroclaw University of Technology, Poland), Marcin Cychowski (Cork Institute of Technology, Ireland)*

Efficient Implementation of Patched LQR for Control and Protection of Multi-mass Drives ▪ *Mario Vasak, Mato Baotic, (University of Zagreb, Croatia), Krzysztof Szabat (Wroclaw University of Technology, Poland), Marcin Cychowski (Cork Institute of Technology, Ireland), Nedjeljko Peric (University of Zagreb, Croatia)*

An Identification Method for Multi-Mass-Systems in Speed-Sensorless Operation ▪ *Henning Zoubek, Mario Pacas (Universitaet Siegen, Germany)*

Observer Based Robust Tension Control for a Segmented Stator Coil Winding Machine ▪ *Stephen Dodds (University of East London, United Kingdom), Gunaratnam Sooriyakumar (Control Techniques Dynamics, United Kingdom)*

Speed control in direct drive with non-stiff load ▪ *Stefan Brock, Dominik Luczak (Poznan University of Technology, Poland)*

Clustering in Optimization of RBF-Based Neural Estimators for the Drive System with Elastic Joint ▪ *Marcin Kaminski (Wroclaw University of Technology, Poland)*

SS16: Contactless Energy Transfer Systems

Tuesday, June 28, 16:30 - 18:30 Room 231

Chair(s): Marian P. Kazmierkowski, Udaya Madawala

High powered IPT stage lighting controller ▪ *Daniel Robertson (PowerbyProxi Ltd, Auckland, New Zealand), Alex Chu, Almas Sabitov, Grant Covic (University of Auckland, New Zealand)*

A Three-Phase Bi-Directional IPT System for Contactless Charging of Electric Vehicles ▪ *Duleepa Thrimawithana, Udaya Madawala (University of Auckland, New Zealand)*

Turn-on Turn-off Zero-Current-Switching Converter in Power Factor Correction (PFC) Application ▪ *Fabrício A. Borges, Luiz C. Freitas, João B. Vieira Jr., Ernane A. A. Coelho, Valdeir J. Farias, Luiz C. G. Freitas (Núcleo de Pesquisa em Eletrônica de Potência - UFU/FEELT, Brazil)*

A New Controller for Bi-directional Inductive Power Transfer Systems ▪ *Michael Neath, Udaya Madawala, Duleepa Thrimawithana (University of Auckland, New Zealand)*

Contactless Battery Charger with Bi-directional Energy Transfer for Plug-in Vehicles with Vehicle-to-Grid Capability ▪ *Rafal Miskiewicz, Artur J. Moradewicz (Electrotechnical Institute, Poland), Marian P. Kazmierkowski (Warsaw University of Technology, Poland)*

Analysis of Inductive Power Transfer Systems for Variable Air Gap and Voltage Supply Frequency ▪ *Slawomir Judek, Krzysztof Karwowski (Gdansk University of Technology, Poland)*

SS18: Network Based Control Systems and Applications

Wednesday, June 29, 16:30 - 18:30 Room 205

Chair(s): Josep M. Fuertes, Mo-Yuen Chow

A Trade-off Model for Performance and Security in Secured Networked Control Systems ▪ *Wente Zeng, Mo-Yuen Chow (North Carolina State University, United States)*

Multiple delay control structure for the double Furuta pendulum ▪ *Vicente Casanova, Julián Salt, Ricardo Pizá, Ăngel Cuenca (Universidad Politécnica de Valencia, Spain)*

Design of networked periodic reset control systems ▪ *Félix Pérez, Alfonso Baños, Joaquín Cervera (Universidad de Murcia, Spain)*

Intermittent Target Tracking Based on Radar Network ▪ *Zhuangzhi Han, Qiang He (Shijiazhuang Mechanical Engineering College, China)*

Evaluation of WirelessHART Enabled Devices in a Controlled Simulation Environment ▪ *Igor Konovalov, Jonas Neander, Mikael Gidlund (ABB AB, Corporate Research, Sweden), Fredrik Österlind, Thiemo Voigt (Swedish Institute of Computer Science, Sweden)*

Networked Sliding Mode Control of the Double Integrator System Using the Event-driven Self-triggered Approach ▪ *Pau Martí, Manel Velasco, Antonio Camacho, Enric X. Martín, Josep M. Fuertes (Upc, Spain)*

SS19: Control of Grid Interactive Wind and PV Power Plants

Wednesday, June 29, 14:00 - 16:00 Room 208

Chair(s): Pedro Rodriguez

Modular Multilevel Inverter with Maximum Power Point Tracking for Grid Connected Photovoltaic application ▪ *Bader Alajmi (Strathclyde University, United Kingdom), Khaled Ahmed (Alexandria University, Egypt), G.P. Adam, Steve Finney, Barry Williams (Strathclyde University, United Kingdom)*

The Ethernet POWERLINK Protocol for Smart Grids Elements Integration ▪ *Miroslaw Wlas (Gdansk University of Technology, Poland), Marek Gackowski, Wojciech Kolbusz (Energy Management Systems Ltd., Poland)*

Power Control of Grid-Connected Photovoltaic Systems ▪ *Roberto Zanasi, Stefania Cuoghi (DII - University of Modena and Reggio Emilia, Italy)*

A Practical Optimization Method for Designing Large PV Plants ▪ *Tamas Kerekes (Aalborg University, Denmark), Eftychios Koutroulis (Technical University of Crete, Greece), Dezso Sera, Remus Teodorescu, Sevnur Eyigün, Markos Katsanevakis (Aalborg University, Denmark)*

Photovoltaic Plants Generation Improvement Using Li-Ion Batteries as Energy Buffer ▪ *Hector Beltran (Universitat Jaume I de Castelló, Spain), Maciej Swierczynski (Aalborg University, Denmark), Alvaro Luna, Gerardo Vazquez (Universitat Politècnica de Catalunya, Spain), Enrique Belenguer (Universitat Jaume I de Castelló, Spain)*

SS20: Fault-Tolerant Control Drive Systems

Wednesday, June 29, 10:30 - 12:30 Room 234

Chair(s): Mohamed Benbouzid

DSP-Based Sensor Fault-Tolerant Control of Electric Vehicle Powertrains ▪ *Bekheïra Tabbache, Mohamed Benbouzid (University of Brest, Brest, France), Abdelaziz Kheloui (Polytechnic Military Academy, Algiers, Algeria), Jean-Matthieu Bourgeot (ENIB, Brest, France)*

A Fault-Tolerant Multiphase Permanent Magnet Generator for Marine Current Turbine Applications ▪ *Fatiha Mekri (Irenav, France), Seifeddine Benelghali (Lsis, France), Mohamed Benbouzid (Lbms, France), Jean Frédéric Charpentier (Irenav, France)*

Fault Detection, Isolation and Control Reconfiguration of Three-Phase PMSM Drives ▪ *Fabien Meinguet (Université Libre de Bruxelles, Belgium), Xavier Kestelyn, Eric Semail (Arts et métiers ParisTech, France), Johan Gyselinck (Université Libre de Bruxelles, Belgium)*

Fault-Tolerant Control of a Blade-pitch Wind Turbine With Inverter-fed Generator ▪ *Vinko Lesic, Mario Vasak, Nedjeljko Peric (University of Zagreb, Croatia), Thomas Wolbank (Vienna University of Technology, Austria), Gojko Joksimovic (University of Montenegro, Montenegro)*

SS22: Fault Detection, Diagnostics and Prognostics in Electromechanical Devices

Wednesday, June 29, 16:30 - 18:30 Auditorium Min

Chair(s): Xu Jian-Xin

Shaft Misalignment Detection Using ANFIS for Speed Sensorless AC Drive with Inverter Output Filter ▪ *Jaroslaw Guzinski (Gdansk University of Technology, Poland), Haitham Abu-Rub (Texas A&M University at Qatar, Qatar), Atif Iqbal (Qatar University, Qatar), Sk Moin Ahmed (Texas A&M University at Qatar, Qatar)*

Multidimensional Intelligent Diagnosis System based on Support Vector Machine ▪ *Miguel Delgado, Juan Antonio Ortega, Antoni Garcia, Juan Jose Cardenas, Luis Romeral (Technical University of Catalonia, Spain)*

An Improved Diagnosis Technique for IGBTs Open-Circuit Fault in PWM-VSI fed Induction Motor Drive ▪ *Mohamed Trabelsi (LSIS, Ecole Centrale Marseille, France / C3S-Ecole Supérieure des Sciences et Techniques de Tunis, Tunisia), Mohamed Boussak, Pascal Mestre (LSIS, Ecole Centrale Marseille, France), Moncef Gossa (C3S-Ecole Supérieure des Sciences et Techniques de Tunis, Tunisia)*

A Study on Automatic Machine Condition Monitoring and Fault Diagnosis for Bearing and Unbalanced Rotor Faults ▪ *Wee Yuan Chen, Jian Xin Xu, Sanjib Kumar Panda (National University of Singapore, Singapore)*

Application of the Empirical Mode Decomposition to condition monitoring of damper bars in synchronous motors ▪ *Jose A. Antonino-Daviu, Jose Roger-Folch, Joan Pons-Llinares, Manuel Pineda-Sanchez (Universidad Politecnica De Valencia, Spain), Rafael B. Perez (University of Tennessee, USA), Cristina Charlton-Perez (Robinson Court, United Kingdom)*

SS23-1: Motion Sensing and Control

Tuesday, June 28, 14:00 - 16:00 Room 205

Chair(s): Toshiyuki Murakami, Kiyoshi Ohishi

Fine Force Control Based on Reaction Force Observer for Electric Injection Molding Machine ▪ *Ryo Furusawa, Kiyoshi Ohishi (Nagaoka University of Technology, Japan), Koichi Kageyama, Masaru Takatsu (Niigata Machine Techno CO.,LTD., Japan), Shiro Urushihara (Kagawa National College of Technology, Japan)*

Improvements In Motion Learning System Using Force Reverse Presentation Control With Variable Force And Time ▪ *Keishi Okuda, Yusuke Suzuki, Kouhei Ohnishi (Keio University, Japan)*

Attitude and Heading System based on EKF Total State Configuration ▪ *Rodrigo Munguia, Antoni Grau (Universitat Politecnica de Catalunya, Spain)*

Motion reconstruction with a low-cost MEMS IMU for the automation of human operated specimen manipulation ▪ *Riccardo Antonello, Ilaria Nogarole, Roberto Oboe (University of Padova, Italy)*

Impulsive Force Reproduction by Environmental Copying System Considering Momentum ▪ *Takuma Shimoichi, Seiichiro Katsura (Keio University, Japan)*

SS23-2: Motion Sensing and Control

Tuesday, June 28, 16:30 - 18:30 Room 205

Chair(s): Roberto Oboe, Kiyoshi Ohishi

Performance Evaluation Of Thrust Wires For Application To Endoscopic Forceps ▪ *Keisuke Sugawara, Yusuke Suzuki, Daisuke Yashiro, Kouhei Ohnishi (Keio University, Japan)*

Modal Transformation In Transformer Gyrator Integrated Type Bilateral Control ▪ *Takahiro Mizoguchi, Yusuke Kasahara, Daisuke Yashiro, Kouhei Ohnishi (Keio University, Japan)*

Multi-Task Control for Dynamically Balanced Two-Wheeled Mobile Manipulator Through Task-Priority ▪ *Cihan Acar, Toshiyuki Murakami (Keio University, Japan)*

Control laws for a distributed traction and steering system ▪ *Manuele Bertoluzzo, Giuseppe Buja, Mario Romeo (University of Padova, Italy)*

Disturbance Rejection Improvement in Non-Redundant Robot Arms by Bi-articular Actuators ▪ *Valerio Salvucci, Yasuto Kimura, Sehoon Oh, Yoichi Hori (University of Tokyo, Japan)*

SS25: Autonomous Robotics and Mechatronics

Thursday, June 30, 10:30 - 12:30 Room 209

Chair(s): Maki K. Habib, Ju-Jang Lee

Proposal of Brain-Computer Interface Architecture to Command a Robotic Wheelchair ▪ *Alessandro Benevides, Teodiano Bastos-Filho, Mario Sarcinelli-Filho (Universidade Federal do Espirito Santo, Brazil)*

An attitude Heading and Reference System: Basic Concepts and Prototype ▪ *Ronan Paixão, Jacy Montenegro, Paulo Rosa (Ime, Brazil)*

Visual Attention and Swarm Cognition Towards Fast and Robust Off-Road Robots ▪ *Pedro Santana (UNINOVA, Universidade Nova de Lisboa, Portugal), Magno Guedes (R&D Division, IntRoSys, S.A., Portugal), Luís Correia (LabMAg, Universidade de Lisboa, Portugal), José Barata (UNINOVA, Universidade Nova de Lisboa, Portugal)*

Model Predictive Control Scheme for the Autonomous Flight of an Unmanned Quadrotor ▪ *Kostas Alexis, George Nikolakopoulos, Anthony Tzes (University of Patras, Greece)*

Humanitarian Demining: Mine Detection and Sensors ▪ *Maki Habib (Auc, Egypt)*

Hovering Control of a Miniature Helicopter Attached to a Platform ▪ *Lucas Santana, Alexandre Brandao, Mario Sarcinelli-Filho (Federal University of Espirito Santo, Brazil), Ricardo Carelli (National University of San Juan, Argentina)*

Industry forum

IF1: Networked Monitoring and Control Systems

Wednesday, June 29, 10:30 -12:30 Room 209

Chair(s): Armando Walter Colombo, Michael W. Condry

Session Introduction and Focus ▪ *Armando Walter Colombo (Schneider Electric, Germany)*

The real-time Enterprise in the SmartGrid era ▪ *Stamatis Karnouskos (SAP, Germany)*

Microsoft Directions (TBD) ▪ *Marcel Tilly (Microsoft, Germany)*

Engineering Framework for Service-oriented Automation Systems ▪ *Marco Mendes (Schneider Electric, Portugal)*

Why is SOA important to the process industry ▪ *Petr Stluka (Honeywell, Czech Republic)*

Computing Architectures for Connect-Continuum Monitoring and Control ▪ *Richard Tyo (Intel, USA)*

IF2: Connected Vehicle Security

Wednesday, June 29, 14:00 -16:00 Room 209

Chair(s): Joachim Taiber, Michael W. Condry

Session Introduction and Focus ▪ *Joachim Taiber (BMW/Clemson University, USA)*

Wireless Wolfsburg – Infrastructure for an eMobility Testbed ▪ *Klaus Schaaf (Volkswagen AG/Wolfburg AG, Germany)*

Designing a secure communication and network infrastructure for the connected vehicle ▪ *Jean-Pierre Seifert (Deutsche Telekom/TU Berlin, Germany)*

Connected vehicle information assurance ▪ *Juan Deng (BMW/Clemson University, USA)*

IF3: Renewable Power Systems & Integration

Wednesday, June 29, 16:30 -18:30 Room 209

Chair(s): Grzegorz Blajszczak, Michael W. Condry

New Trends in Medium-Voltage Power Converters and Motor Drives ▪ *Grzegorz Blajszczak (PSE Operator SA, Poland)*

Offshore transformer Platform Design ▪ *Jan Talaska (Det Norske Veritas, Poland)*

State of the art 100% water cooled plasma DC generator with ultra fast arc quenching circuit for photovoltaic applications ▪ *Lukasz Zyskowski (HUETTINGER Electronic Sp. z o.o., Poland)*

Usability of Industrial automation technologies for the design and management of Smart Grids ▪ *Antonio Valentini (O³nedia, Italy)*

Dialog sessions

Dialog 1: **Power Electronics**
Tuesday, June 28, 16:30 - 18:30 Hall
Chair(s): Pedro Rodriguez, Jose I. Leon

Adaptive Optimal Controller based on Genetic Algorithm for Digital DC-DC Converters ▪ *Huey Chian Foong (Nanyang Technological University, Singapore), Meng Tong Tan (Institute of Microelectronics, Singapore), Yuanjin Zheng, Iris Ng (Nanyang Technological University, Singapore)*

CCM and DCM Operation Analysis of Cascaded Quasi-Z-Source Inverter ▪ *Dmitri Vinnikov, Indrek Roasto (Tallinn University of Technology, Estonia), Ryszard Strzelecki, Marek Adamowicz (Gdynia Maritime University, Poland)*

Space Vector Modulation Techniques Applied in Voltage Source Converters of Ultrahigh Speed Induction Machines ▪ *Peter Stumpf, Daniel T. Sepsi, Rafael Kalman Jardan, Istvan Nagy (Budapest University of Technology and Economics, Hungary)*

Study of Hybrid Active Control Strategies for the Bus-Pumping Cancellation in the Half-Bridge Class-D Audio Power Amplifier ▪ *Vicent Sala, Luis Romeral, Antoni García, Miguel Delgado (MCIA Research Center - Technical University of Catalonia UPC, Spain)*

Cascaded Neutral-Clamped Inverters with Flexible Synchronized PWM for Photovoltaic Installations ▪ *Gabriele Grandi (University of Bologna, Italy), Valentin Oleschuk (Institute of Power Engineering of the Academy of Sciences, Moldova), Filopimin A. Dragonas (University of Bologna, Italy)*

Design and Implementation of an Ultracapacitor Test System ▪ *Hasan Huseyin Eroglu (Gülhane Medical Military Academy, Turkey), Ahmet M. Hava (Middle East Technical University, Turkey)*

Design of Feedback Gain in Network-Based Control System for Paralleled Inverters ▪ *Yao Zhang, Hao Ma, Qian Guo, Jin Guo (Zhejiang University, China)*

Stability Investigation of Control System for Power Electronic Converter Acting as Load Interface in AC Distribution System ▪ *Nadeem Jelani, Marta Molinas (Ntnu, Norway)*

Eliminating Leakage Currents in Transformerless Z-Source Inverters for Photovoltaic Systems ▪ *Fabricio Bradaschia, Marcelo C. Cavalcanti, Pedro E. P. Ferraz (Universidade Federal de Pernambuco, Brazil), Euzeli C. Santos Jr. (Universidade Federal de Campina Grande, Brazil), Francisco A. S. Neves (Universidade Federal de Pernambuco, Brazil)*

Voltage Regulator System Based on a PWM AC Chopper Converter ▪ *Jose María Flores Arias, A. Moreno-Muñoz, F. Domingo-Perez, V. Pallares-Lopez, D. Gutierrez (Univ. de Cordoba, Spain)*

Design and application of a two degrees of freedom control with a repetitive controller in a single phase inverter ▪ *Ruben Ortega, Gabriel Garcera, Emilio Figueres (Upv, Spain), Oscar Carranza (Ipn, Mexico), Cesar Leonardo Trujillo (Upv, Spain)*

Load-Side Snubbers for Recovering Leakage Energy ▪ *Jeff Graw, Horst Zimmermann (Vienna University of Technology, Austria)*

A Passive Controller-Observer for Coordination of Converters in a Fuel Cell System ▪ *Mickael Hilairet, Olivier Béthoux (LGEP, France)*

Performance Improvement of the Droop Control for Single-Phase Inverters ▪ *Gustavo M. S. Azevedo, Marcelo C. Cavalcanti, Francisco A. S. Neves (Federal University of Pernambuco, Brazil), Pedro Rodriguez, Joan Rocabert (Polytechnical University of Catalunya, Spain)*

Double Resonant Converter Topology with Fast Switching Semiconductors for Lead-Acid Battery Charger used in Hybrid Electric Locomotive ▪ *Alexandre de Bernardinis, Stéphane Butterbach, Richard Lallemand (Ifsttar Ltn, France), Alain Jeunesse (SNCF, France), Gérard Coquery (Ifsttar Ltn, France), Philippe Aubin (Faiveley Transport, France)*

Comparison of DBI and ZSI Supply for PM Brushless DC Drives Powered by Fuel Cell ▪ *Giuseppe Buja, Ritesh Kumar Keshri (University of Padova, Italy), Roberto Menis (University of Trieste, Italy)*

A wide-band modeling of DC-DC two-transistor flyback converter ▪ *Marek Turzynski, Maciej Haras, Grzegorz Kostro, Piotr Musznicki (Gdansk University of Technology, Poland)*

Study of harmonic generated by electromagnetic and electronic ballast used in Street Lighting ▪ *Aurora Gil-de-Castro, Antonio Moreno-Munoz, Jose María Flores Arias (University of Cordoba, Spain), Juan Jose Gonzalez-de-la-Rosa (University of Cadiz, Spain), Víctor Pallares-Lopez (University of Cordoba, Spain)*

Five-Phase and Six-Phase Converters with Synchronized PWM: An Overview ▪ *Gabriele Grandi (University of Bologna, Italy), Valentin Oleschuk (Institute of Power Engineering of the Academy of Sciences, Moldova), Filopimin A. Dragonas (University of Bologna, Italy)*

Design of Current-fed DC/DC converter with closed loop control system ▪ *Aleksandrs Andreiciks, Ingars Steiks, Oskars Krievs, Leonids Ribickis (Riga Technical university, Latvia)*

Modelling and control study of two hybrid structures for street lighting ▪ *Mohamed Becherif (UTBM, FEMTO-ST/FCLab, France), Mohamed Yacine Ayad (R&D in Industrial Hybrid Vehicles Applications, France), Daniel Hissel (UFC, FEMTO-ST/FCLab, France)*

Determination of Stable Region of Controller Parameters for Series-Parallel Resonant Converter with Capacitive Output Filter ▪ *Kuntal Mandal (Indian Institute of Technology Kharagpur, India), Soumitro Banerjee (Indian Institute of Science Education and Research, Kolkata, India), Chandan Chakraborty (Indian Institute of Technology Kharagpur, India)*

Transformerless DC-DC Step-up Topologies with Symmetrical Outputs for Renewable Energy Applications ▪ *Felipe J. C. Padilha, Walter I. Suemitsu (Federal University of Rio de Janeiro - UFRJ, Brazil), Maria D. Bellar (State Univeristy of Rio de Janeiro - UERJ, Brazil)*

Equipments characterization methods for stability analysis of DC networks ▪ *Madiha Charrada, Sylvain Girinon, Hubert Piquet, Nicolas Roux (Laplace Laboratory - CNRS/INPT/UPS, France)*

FPGA-based Quasi-Sliding Mode Control of a DC-DC boost converter ▪ *Carlos Carrejo (Total, France), Enric Vidal-Idiarte (Urv, Spain), Eliana Arango, Carlos Ramos-Paja (Universidad Nacional, Colombia), Marc Vermeersch (Total, France), Corrine Alonso (CNRS-LAAS, France)*

Design of Inverting Buck-Boost DC-DC Converter with Input-to-Output By-Pass Capacitor ▪ *Nicola Femia, Giulia Di Capua, Antonietta De Nardo (University of Salermo, Italy)*

An Overview of Methods to Increase the Power Handling Capability of Single Stage AC-DC Converters ▪ *Mohammed Agamy (GE Global Research Center, USA), Praveen Jain (Queen's University, Canada)*

An Efficient Discontinuous Pulse Width Modulation Algorithm for Multileg Voltage-Source Converters ▪ *Bartlomiej Ufnalski, Arkadiusz Kaszewski, Lech M. Grzesiak (Warsaw University of Technology, Poland)*

Control of series active compensator using estimation of the filter capacitor current ▪ *Krzysztof Piatek (AGH - University of Science and Technology, Poland)*

Silicon Carbide Inverter with two series Z-networks ▪ *Jacek Rabkowski, Mariusz Zdanowski, Roman Barlik (Warsaw University of Technology, Poland)*

Higher Harmonics of Converter Currents in Energy Conversion System of Small Water Plants ▪ *Tadeusz Sobczyk, Witold Mazgaj, Zbigniew Szular, Tomasz Wegiel (Cracow University of Technology, Poland)*

Power Management in a DC Microgrid Supported by Energy Storage ▪ *Grzegorz Iwanski, Pawel Staniak, Wlodzimierz Koczara (Warsaw University of Technology, Poland)*

Dialog 2: **Electrical Machines and Drives**
Wednesday, June 29, 10:30 - 12:30 Hall
Chair(s): Grzegorz Iwanski, Dimitri Vinnikov

Concept and Implementation of a Simplified Speed Control Strategy for Survivable Induction Motor Drives ▪ *Xiaodong Shi, Mahesh Krishnamurthy (Illinois Institute of Technology, USA)*

A SISO H∞ Voltage Controller Associated With a PMG-Thyristor Excitation Structure ▪ *Abdallah Barakat (Laboratoire LAII & Leroy Somer Motors company, France), Slim Tnani, Gérard Champenois (Laboratoire LAII, France), Emile Mouni (Leroy Somer Motors company, France)*

A novel reliable indicator of stator windings fault in induction motor extracted from the symmetrical components ▪ *Monia Bouzid (LSE-ENIT, University of El Manar, Tunisia), Gérard Champenois (LAII- ENSIP, University of Poitiers, France)*

Practical Demonstration Of An Electromagnetic Levitation For A Cylindrical Rod ▪ *Subrata Banerjee (Nit Durgapur, India), Rupam Bhaduri (N.F.E.T., Durgapur, India), Pabitra Biswas (Aec, Asansol, India)*

Investigations on sensitivity of FRA method in diagnosis of interturn faults in transformer winding ▪ *Andrzej Wilk, Dominik Adamczyk (Gdansk University of Technology, Poland)*

PWM Voltage Source Inverter Rating with the Power Distribution Law for a DFIM Speed Drive ▪ *Sejir Khojet El Khil, Ilhem Slama-Belkhodja (Lse-Enit, Tunisia), Maria Pietrzak-David (LAPLACE, France)*

Advanced Procedures for Calibration of Instrument Transformer Burdens ▪ *Karel Draxler (Czech Technical University in Prague, Czech Republic), Renata Styblikova, Michal Ulvr (Czech Metrology Institute, Czech Republic)*

Control of a Hybrid Excitation Synchronous Generator Connected to a Diode Rectifier Supplying a DC Bus ▪ *Rita Mbayed (SATIE, University of Cergy-Pontoise, CNRS, France), Georges Salloum (Lebanese University, Lebanon), Lionel Vido, Eric Monmasson (SATIE, University of Cergy-Pontoise, CNRS, France), Mohamed Gabsi (SATIE, ENS Cachan, CNRS Universud, France)*

The influence of permanent magnets' width and number on the mechanical torque of a magnetic coupling machine ▪ *Baiba Ose, Vladislav Pugachov, Svetlana Orlova (Institute of Physical Energetics, Latvia), Juris Vanags (Biotechnical Centre, Latvia)*

Model Predictive Speed and Vibration Control of Dual-Inertia PMSM Drives ▪ *Marcin Cychowski (Cork Institute of Technology, Ireland), Piotr Serkies, Radoslaw Nalepa, Krzysztof Szabat (Wroclaw University of Technology, Poland)*

Linear Generalized Predictive Speed Control of Induction Motor Drives ▪ *Patxi Alkorta, Oscar Barambones, José Antonio Cortajarena, Pedro Ălvarez (University of the Basque Country (UPV/EHU), Spain)*

Sensorless Position Control of Six-phase Induction Machine Using Fuzzy-PI System ▪ *Franck Betin (Upjv, France)*

An Axial Flux Permanent Magnet Machine with Charged Resin Stator Core ▪ *Roberto Di Stefano, Fabrizio Marignetti (University of Cassino, Italy)*

Energy balance of electric motors based on Infrared Thermography ▪ *Maria Jose Picazo-Rodenas, Rafael Royo, Jose A. Antonino-Daviu, Jose Roger-Folch (Universidad Politecnica De Valencia, Spain)*

Estimation of Acoustic Noise of P.M. Motor by Multi-Physical model ▪ *Slawomir Bujacz, Janusz Nieznanski (Gdansk University of Technology, Poland)*

Broadband Modeling of Motor Cable Impact on Common Mode Currents in VFD ▪ *Jaroslaw Luszcz (Gdansk University of Technology, Poland)*

Effects of Inverter Pulses on the Electrical Insulation System of Motors ▪ *Barbara Florkowska, Pawel Zydron (AGH - University of Science and Technology, Poland), Marek Florkowski (ABB Corporate Research Kraków, Poland)*

A Computational Method of Temperature Distribution in High Frequency Planar Transformers ▪ *Concettina Buccella, Carlo Cecati, Filippo de Monte (University of L'Aquila, Italy)*

Sensorless Control of High-Speed PM BLDC Motor ▪ *Dawid Makiela (Silesian University of Technology, Poland)*

Half-order modelling of ferromagnetic sheet ▪ *Szymon Racewicz (Gdansk University of Technology, Poland), Delphine Riu, Nicolas Retiere (Grenoble University, France), Piotr J. Chrzan (Gdansk University of Technology, Poland)*

Permanent magnet synchronous motor discrete linear quadratic speed controller ▪ *Lech M. Grzesiak (Warsaw University of Technology, Poland), Tomasz Tarczewski (Nicolaus Copernicus University, Poland)*

Dialog 3: **Miscellaneous**

Wednesday, June 29, 16:30 - 18:30 Hall

Chair(s): Patricio Cortes, Jacek Rabkowski

Shunt Active Power Filter Control Using Fuzzy Logic Controllers ▪ *Georgios Tsengenes, Georgios Adamidis (Democritus University of Thrace, Greece)*

Rdson behavior in various MOSFET families ▪ *Pierre Petit (LMOPS, University Paul Verlaine of Metz and Supelec, France), Abdallah Zegaoui (LMOPS, University Paul Verlaine of Metz and Supelec, France / University of Hassiba Ben Bouali, Algeria), Jean-Paul Sawicki,Michel Aillerie, Jean-Pierre Charles (LMOPS, University Paul Verlaine of Metz and Supelec, France)*

Estimating KNXnet/IP Routing Congestion ▪ *Salvatore Cavalieri (University of Catania, Italy)*

Model of a Hybrid Renewable Energy System: Control, Supervision and Energy Distribution ▪ *Dada Delimustafic, Jasmina Islambegovic, Abdulah Aksamovic, Semsudin Masic (University of Sarajevo, Bosnia and Herzegovina)*

Power Quality Considerations of Heavy Loads of CFL on Distribution System ▪ *Ali Eltamaly (King Saud University, Saudi Arabia)*

A Model of Magnetostrictive Actuators for Active Vibration Control ▪ *Marco Mauri (Politecnico di Milano, Italy)*

Control Network for Modern Street Lighting Systems ▪ *Gustavo Weber Denardin, Carlos Henrique Barriquello, Rafael Adaime Pinto, Marco Antonio Dalla Costa, Alexandre Campos, Ricardo Nederson do Prado (Federal University of Santa Maria, Brazil)*

Stable Iterative Feedback Tuning Method for Servo Systems ▪ *Mircea-Bogdan Radac, Radu-Emil Precup (Politehnica University of Timisoara, Romania), Emil M. Petriu (University of Ottawa, Canada), Stefan Preitl, Radu-Codrut David (Politehnica University of Timisoara, Romania)*

Online Fault Detection of Induction Motors Using Frequency Domain Independent Components Analysis ▪ *Zhaoxia Wang (Institute of High Performance Computing, Singapore), Che-Sau Chang (National University of Singapore, Singapore)*

Supervisory Evolutionary Optimization Strategy for Adaptive Maintenance Schedules ▪ *Zhaoxia Wang (Institute of High Performance Computing, Singapore), Che-Sau Chang (National University of Singapore, Singapore)*

Industrial robot path optimization approach with asynchronous FLY-BY in joint space ▪ *Davis Meike (Daimler AG, Germany), Leonids Ribickis (Riga Technical University, Latvia)*

Voltage Sag Mitigation in Offshore Oil Rig Power System by Dynamic Voltage Restorer ▪ *Di Wu, Che Sau Chang (National University of Singapore, Singapore)*

A Survey on Pneumatic Muscle Actuators Modeling ▪ *Eleni Kelasidi, George Andrikopoulos, George Nikolakopoulos, Stamatis Manesis (University of Patras, Greece)*

Gain-scheduling-based Droop Control for Universal Operation of Small Wind Turbine Systems ▪ *Antonella Nagliero, Rosa Anna Mastromauro, Domenico Ricchiuto, Marco Liserre (Politecnico di Bari, Italy), Michle Nitti (AVIO SpA, Italy)*

Density and viscosity measurements in lead acid batteries by QCM sensor ▪ *Ana María Cao-Paz, Loreto Rodriguez-Pardo, Jose Fariña (University of Vigo, Spain)*

A Confirmation-Based Geocast Routing Algorithm For Street Lighting System ▪ *Rodrigo Palucci Pantoni (Federal Institute of São Paulo, Brazil), Dennis Brandão (University of São Paulo, Brazil)*

The Methods of Broadcasting of Information in Ad-hoc Wireless Networks with Mobile Stations ▪ *Dariusz Koscielnik, Jacek Stepien (AGH University of Science and Technology, Poland)*

Location-Based Optimal Route Zone Finding Algorithm for Wireless Sensor Networks in Building Automation ▪ *Xiaohui Li (Wuhan University of Science and Technology, China), Seung Ho Hong (Hanyang University, Korea)*

Synchronism with Software-Based IEEE 1588-2008 for SmartGrid ▪ *Víctor Pallares-Lopez, Antonio Moreno-Muñoz (University of Cordoba, Spain), Juan Jose Gonzalez de la Rosa (University of Cadiz, Spain), Miguel Jesus Gonzalez-Redondo, Rafael Real-Calvo, Isabel Moreno-Garcia, Jose María Flores Arias, Aurora Gil de Castro (University of Cordoba, Spain)*

Network-Control Cosimulation Framework for NCS ▪ *Miguel Diaz-Cacho, Emma Delgado, Antonio Barreiro (University of Vigo, Spain)*

Simulation Possibility of Performance of Avalanche Diode Using a Combination Wave Generator ▪ *Zofia Wróbel (PKP Polish Railway Lines JSC, Railway Lines Establishment in Rzeszów, Poland)*

Short-term load forecasting in air-conditioned non-residential Buildings ▪ *Yoseba Penya (DeustoTech - University of Deusto, Spain), Cruz Enrique Borges, Denis Agote, Ivan Fernandez (DeustoTech, Spain)*

Design, Construction and Control of a Fluidic Robotic Joint for Compliant Legged Locomotion ▪ *Luis Sentis (UT Austin, USA), Javier Gamez Garcia (Jaen University, Spain), Benito R. Fernandez, Mathew R. Gonzales, Nicholas Paine (UT Austin, USA)*

Criteria for Comparison of Energy Efficient Lamps ▪ *Ali Eltamaly (King Saud University, Saudi Arabia)*

A Standard-based Software Infrastructure to Support Energy Efficiency Using Renewable Energy Sources ▪ *Celson Lima, Vasco Gomes, José Lima, João Martins, José Barata, Luís Ribeiro, Gonçalo Cândido (Universidade Nova de Lisboa, Portugal)*

Chaotic mixing with adaptively controlled permanent magnet motor ▪ *Jacek Kabzinski (Technical University of Lodz, Poland)*

An efficient CORDIC arithmetic unit for 3-Phase voltage grid synchronization ▪ *Fran González-Espín, Emilio Figueres, Gabriel Garcerá, Iván Patrao (Universidad Politécnica de Valencia, Spain)*

Fitness Function Scaling in the Evolutionary Method of Path Planning ▪ *Piotr Kolendo, Roman Smierzchalski, Bartosz Jaworski (Gdansk University of Technology, Poland)*

State of the art. 100% water cooled plasma DC generator with ultra fast arc quenching circuit for photovoltaic applications ▪ *Krzysztof Giedroyc, Dariusz Sobczuk (Warsaw University of Technology, Poland), Lukasz Zyskowski, Marcin Zelechowski (HUETTINGER Electronic sp. z o.o., Poland), Marek Jasinski (Warsaw University of Technology, Poland)*

Microprocessor system for controlling the operation of renewable energy resources ▪ *Miroslaw Wlas (Gdansk University of Technology, Poland), Wojciech Kolbusz, Marek Gackowski (Energy Management Systems, Gdansk, Poland)*

Student forum

SF1: Student forum 1

Tuesday, June 28, 14:00 - 16:00 Room 209

Chair(s): Pedro Rodriguez, Marek Jasinski, Marek Turzynski

Conveyor – different approaches based on student-made models ▪ *Konrad Lubinski, Krzysztof Cirocki, Kamil Bargiel, Michal Meyer, Piotr Trella, Wiktor Miszke (Gdynia Maritime University, Poland)*

A Study of Optimized Facial Emotion Recognition using DBNs with HS ▪ *Kwang-Eun Ko, Sang-Kyung Lee (Chung-Ang University, Korea)*

Acoustic Feature based Automatic Classification of Light and Shade of Music ▪ *Junheong Park, Seung-Min Park (Chung-Ang University, Korea)*

Modeling and Simulation of the BLDC Motor in MATLAB GUI ▪ *Tibor Balogh, Viliam Fedak, Frantisek Durovsky (FEI TU of Košice, Slovak Republic)*

Control of a Leader–Follower Mobile Robotic Swarm Based on the NXT Educational LEGO Platform ▪ *Demetris Zermas (University of Patras, Greece)*

The guidelines for autonomous data logger design ▪ *Alexander Suzdalenko (Riga Technical University, Latvia)*

SF2: Student forum 2

Tuesday, June 28, 16:30 - 18:30 Room 209

Chair(s): Pedro Rodriguez, Marek Jasinski, Marek Turzynski

A Snap-back Suppressed Shorted-Anode Lateral Trench Insulated Gate Bipolar Transistor (LTIGBT) with Insulated Trench Collector ▪ *Juhyun Oh, Reum Oh, Hyun Soo Kim (Korea University, Korea)*

Control Strategies for VSC-based HVDC Transmission System ▪ *Ana-Irina Stan, Daniel-Ioan Stroe, Rodrigo da Silva (Aalborg University, Denmark)*

Influence of the Sign Function Approximation Form on Performance of the Sliding-Mode Speed Observer for Induction Motor Drive ▪ *Grzegorz Tarchala (Wroclaw University of Technology, Poland)*

Modelling the Photovoltaic Module ▪ *Markos Katsanevakis (Department of Energy Technology, Denmark)*

Overview of Power Converter Designs Feasible for High Voltage Transformer-Less Wind Turbine ▪ *Michal Sztykiel (Aalborg University, Denmark)*

Modeling Lifetime of High Power IGBTs in Wind Power Applications – An overview ▪ *Cristian Busca (Aalborg University, Denmark)*

Sessions chart

DAY 1, TUESDAY, JUNE 28

08:00 - 09:00	Registration										
09:00 - 10:00	**Opening ceremony** *(Auditorium Max)*										
10:00 - 10:30	Coffee break										
10:30 - 11:30	**Keynote 1** by Hirofumi Akagi (*Auditorium Max)*										
11:30 - 12:30	**Keynote 2** by Marek Florkowski *(Auditorium Max)*										
12:30 - 14:00	Lunch										
14:00 - 16:00	**SF1** *Room 209*	**SS08** *Room 204*	**SS23-1** *Room 205*	**TT4-1** *Audit. Max*	**TT2-1** *Audit. Min*	**TT5-1** *Room 230*	**TT3-1** *Room 235*	**SS05-1** *Room 234*	**TT1** *Room 231*	Void *Room 208*	Void *Hall*
16:00 - 16:30	Coffee break										
16:30 - 18:30	**SF2** *Room 209*	**TT8-1** *Room 204*	**SS23-2** *Room 205*	**TT4-2** *Audit. Max*	**TT2-2** *Audit. Min*	**TT5-2** *Room 230*	**TT3-2** *Room 235*	**SS05-2** *Room 234*	**SS16** *Room 231*	Void *Room 208*	**Dialog 1** *Hall*
18:30 - 19:30	Registration										
19:30 - 22:30	**Welcome party at the Gdansk University of Technology**										

DAY 2, WEDNESDAY, JUNE 29

08:00 - 09:00	Registration										
09:00 - 10:00	**Keynote 3** by Xavier Roboam *(Auditorium Max)*										
10:00 - 10:30	Coffee break										
10:30 - 12:30	**IF1** *Room 209*	**TT6-1** *Room 204*	**SS06** *Room 205*	**TT4-3** *Audit. Max*	**TT2-3** *Audit. Min*	**SS12** *Room 230*	**SS14-1** *Room 235*	**SS20** *Room 234*	**TC1** *Room 231*	Void *Room 208*	**Dialog 2** *Hall*
12:30 - 14:00	Lunch										
14:00 - 16:00	**IF1 IF2** *Room 209*	**TT6-2** *Room 204*	**SS11** *Room 205*	**TT4-4** *Audit. Max*	**TT2-4** *Audit. Min*	**TC2** *Room 230*	**SS14-2** *Room 235*	**SS07** *Room 234*	**SS15** *Room 231*	**SS19** *Room 208*	Void *Hall*
16:00 - 16:30	Coffee break										
16:30 - 18:30	**IF3** *Room 209*	**SS02** *Room 204*	**SS18** *Room 205*	**TT4-5** *Audit. Max*	**SS22** *Audit. Min*	**TT5-3** *Room 230*	**TT7** *Room 235*	**SS04** *Room 234*	**SS10** *Room 231*	Void *Room 208*	**Dialog 3** *Hall*
18:30 - 19:30	Registration										
19:30 - 22:30	**Gala dinner at Pick & Roll Club, Sopot**										

DAY 3, THURSDAY, JUNE 30

08:00 - 09:00	Registration								
09:00 - 10:00	**Keynote 4** by Johann W. Kolar *(Auditorium Max)*								
10:00 - 10:30	Coffee break								
10:30 - 12:30	**SS25** *Room 209*	**TT6-3** *Room 204*	**TT8-2** *Room 205*	**TT4-6** *Audit. Max*	**TT2-5** *Audit. Min*	**AdCom** *Room 230*	**AdCom** *Room 235*	Void *Room 234*	Void *Hall*
12:30 - 14:00	Lunch								
14:00 - 16:00	Void *Room 209*	**TT6-4** *Room 204*	**SS13** *Room 205*	**TT4-7** *Audit. Max*	Void *Audit. Min*	**AdCom** *Room 230*	**AdCom** *Room 235*	Void *Room 234*	Void *Hall*
16:00 - 16:30	Coffee break								
16:30 - 17:30	Void *Room 209*	Void *Room 204*	Void *Room 205*	Void *Audit. Max*	Void *Audit. Min*	**AdCom** *Room 230*	**AdCom** *Room 235*	Void *Room 234*	Void *Hall*

TECHNICAL TRACK AND SPECIAL SESSION CODES

TT1	Building Automation and Smart Homes
TT2	Electrical Machines and Drives
TT3	Factory Automation and Industrial Informatics
TT4	Industrial Electronics and Power Converters
TT5	Mechatronics, Robotics and Telecommunication
TT6	Power Systems and Renewable Energy
TT7	Sensors, Actuators and System Integration
TT8	Signal Processing and Computational Intelligence
SF	Student Forum
IF	Industry Forum
SS02	Microgrids
SS04	Industrial Applications of FPGAs and Embedded Systems
SS05	FPGA for Industrial Control Systems
SS06	Power Quality and Demand Control in Distributed Energy Systems with Renewables
SS07	Electric Drives for Hybrid and Plug-in Hybrid Electric Vehicles
SS08	Distributed State Estimation and Fault Diagnosis for Distribution Management Systems in Active Networks and Smart Grids
SS10	Service-Oriented Architectures in Process Monitoring and Control
SS11	Smart Devices for Renewable Energy Systems
SS12	Agent Technology in Manufacturing Automation
SS13	Predictive Control of Power Converters and Drives
SS14	Multilevel Converters
SS15	Identification and Control Concepts for Multi-mass Systems
SS16	Contactless Energy Transfer Systems
SS18	Network Based Control Systems and Applications
SS19	Control of Grid Interactive Wind and PV Power Plants
SS20	Fault-Tolerant Control Drive Systems
SS22	Fault Detection, Diagnostics and Prognostics in Electromechanical Devices
SS23	Motion Sensing and Control
SS25	Autonomous Robotics and Mechatronics

Index of authors and attendees

Note: People who are expected to attend the conference are marked by check marks. The numbers in curly braces to the right of session IDs are page numbers on which the session details are given.

Author / attendee	Session ID
Barakat, Abdallah ☑	Dialog 2 {45}
Barambones, Oscar	Dialog 2 {45}
Barata, José ☑	Dialog 3 {46}
Barata, José ☑	SS12 {36}
Barata, José ☑	SS12 {36}
Barata, José ☑	SS25 {41}
Barbosa, José	SS12 {36}
Bargiel, Kamil ☑	SF1 {48}
Barlik, Roman	Dialog 1 {43}
Barragán, Luis A.	SS04 {33}
Barreiro, Antonio	Dialog 3 {46}
Barriquello, Carlos Henrique	Dialog 3 {46}
Barriviera, Rodrigo	TT6-1 {29}
Bastos-Filho, Teodiano ☑	SS25 {41}
Bastos-Filho, Teodiano ☑	TT8-2 {32}
Baturone, Iluminada	SS04 {33}
Bayati-Podeh, Mohammad	TT6-1 {29}
Becherif, Mohamed ☑	Dialog 1 {43}
Belenguer, Enrique	SS19 {39}
Bellar, Maria D.	Dialog 1 {43}
Beltran, Hector	SS19 {39}
Ben Othman, Slim	TT8-1 {32}
Ben Salem, Ahmed Karim	TT8-1 {32}
Ben Saoud, Slim	TT8-1 {32}
Benbouzid, Mohamed ☑	SS20 {39}
Benbouzid, Mohamed ☑	SS20 {39}
Benelghali, Seifeddine	SS20 {39}
Benevides, Alessandro	SS25 {41}
Benysek, Grzegorz ☑	Tutorial 1 {17}
Berger, Thierry	SS12 {36}
Bernal, Carlos	TT4-2 {26}
Bernhoff, Hans	SS07 {35}
Bertoluzzo, Manuele ☑	SS23-2 {41}
Béthoux, Olivier	Dialog 1 {43}
Betin, Franck ☑	Dialog 2 {45}
Bhaduri, Rupam	Dialog 2 {45}
Bialasiewicz, Jan T. ☑	
Bianconi, Enrico	TT4-4 {26}
Bianconi, Enrico	TT4-4 {26}
Biel, Domingo	SS11 {36}
Bierhoff, Michael ☑	TT2-1 {22}
Bilgic, Eyup	TT7 {31}
Birecik, Serdar	TT7 {31}
Bisogno, Fabio	TT4-3 {26}
Biswas, Pabitra	Dialog 2 {45}
Blaabjerg, Frede ☑	TT4-1 {25}
Blaabjerg, Frede ☑	TT2-2 {23}

Author / attendee	Session ID
Blajszczak, Grzegorz	IF3 {42}
Bloch, Richard	TT7 {31}
Bobrowska-Rafal, Malgorzata	TT6-3 {30}
Bodo, Nandor ☑	SS14-2 {37}
Bogalecka, Elzbieta ☑	
Bogosyan, Seta	TT5-3 {29}
Bogónez-Franco, Paco ☑	SS06 {34}
Bogónez-Franco, Paco ☑	SS06 {34}
Bogusz, Piotr ☑	TT2-1 {22}
Bogusz, Piotr ☑	TT2-5 {24}
Boldea, Ion	TT2-2 {23}
Bolea, Yolanda	TT6-3 {30}
Bonifacio, Tatiana G.	TT3-2 {25}
Bordons, Carlos	SS13 {37}
Borges, Fabrício A.	SS16 {38}
Bourennane, Abdelhakim	TT4-5 {27}
Bourgeot, Jean-Matthieu	SS20 {39}
Boussak, Mohamed ☑	SS22 {40}
Boussak, Mohamed ☑	TT2-3 {23}
Bouzid, Monia	Dialog 2 {45}
Bradaschia, Fabricio	Dialog 1 {43}
Braga, Henrique A. C. ☑	TT4-3 {26}
Braga, Henrique A. C. ☑	TT4-3 {26}
Brandao, Alexandre ☑	SS25 {41}
Brandao, Alexandre ☑	TT6-4 {31}
Brandao, Dennis ☑	TT3-2 {25}
Brandão, Dennis ☑	Dialog 3 {46}
Brito, Moacyr ☑	TT6-2 {30}
Brito, Moacyr ☑	TT6-2 {30}
Brito, Moacyr ☑	TT6-3 {30}
Brock, Stefan ☑	SS15 {38}
Brox, Piedad	SS04 {33}
Bruckner, Dietmar ☑	TT8-1 {32}
Buccella, Concettina	Dialog 2 {45}
Buja, Giuseppe	Dialog 1 {43}
Buja, Giuseppe	SS23-2 {41}
Bujacz, Slawomir	Dialog 2 {45}
Burlacu, Adrian	TT5-3 {29}
Busca, Cristian	SF2 {48}
Butterbach, Stéphane	Dialog 1 {43}
Calderaro, Vito	SS08 {35}
Calvente, Javier	TT4-4 {26}
Calvente, Javier	TT4-4 {26}
Camacho, Antonio	SS18 {39}
Campos, Alexandre	Dialog 3 {46}
Campos, Alexandre	TT4-3 {26}
Candido, Goncalo	SS12 {36}

Author / attendee	Session ID
Lima, Celson	TT3-1 {24}
Lima, José	Dialog 3 {46}
Lindgren, Per	SS10 {35}
Lingemann, Max	TT6-4 {31}
Linh, Nguyen Ngoc	TT2-2 {23}
Linh, Pham Thi Thuy ☑	SS14-1 {37}
Lin-Shi, Xuefang ☑	SS05-2 {34}
Lipinski, Lech ☑	
Liserre, Marco ☑	Dialog 3 {46}
Lizana, Ricardo	SS13 {37}
Llamazares, Angel	TT8-1 {32}
Llor, Ana M.	TT2-2 {23}
Llor, Ana Maria	SS13 {37}
Llorca, David F.	TT8-1 {32}
Lo Bello, Lucia	TT3-2 {25}
Loia, Vincenzo	SS08 {35}
Lomami Kala-Konga, Cedrick	SS14-1 {37}
Lopes, Luiz ☑	SS06 {34}
Lubinski, Konrad	SF1 {48}
Lucia, Oscar	SS04 {33}
Luczak, Dominik ☑	SS15 {38}
Luna, Alvaro	SS19 {39}
Luo, Ren C. ☑	TT8-2 {32}
Luo, Ren C. ☑	TT5-3 {29}
Luszcz, Jaroslaw ☑	Dialog 2 {45}
Ma, Hao ☑	Dialog 1 {43}
Ma, Hao ☑	TT4-6 {27}
Ma, Ke ☑	TT4-1 {25}
Madawala, Udaya ☑	TT4-2 {26}
Madawala, Udaya ☑	SS16 {38}
Madawala, Udaya ☑	SS16 {38}
Madonski, Rafal ☑	TT5-2 {29}
Maeda, Yoshihiro ☑	TT5-2 {29}
Mahdavian, Mehdi ☑	TT6-1 {29}
Mahdavian, Mehdi ☑	TT6-1 {29}
Mahdavian, Mehdi ☑	TT6-1 {29}
Makiela, Dawid ☑	Dialog 2 {45}
Malinowski, Aleksander ☑	
Malinowski, Mariusz ☑	TT6-2 {30}
Malinowski, Mariusz ☑	TT6-3 {30}
Malz, Christoph ☑	
Mamarelis, Emilio	SS11 {36}
Mancilla-David, Fernando	SS06 {34}
Mandal, Kuntal	Dialog 1 {43}
Manesis, Stamatis ☑	Dialog 3 {46}
Mantala, Chawanakorn ☑	TT2-3 {23}
Maret, Yannick ☑	TT7 {31}
Marignetti, Fabrizio	Dialog 2 {45}
Marinescu, Corneliu	SS02 {33}
Marinescu, Corneliu	TT2-4 {24}
Martí, Pau	SS18 {39}
Martín, Enric X.	SS18 {39}
Martin, Terry ☑	
Martinez, Herminio	TT6-3 {30}
Martinez, Ruben	TT6-3 {30}
Martínez-Iturbe, Abelardo	TT4-2 {26}
Martínez-Rodríguez, Macarena C.	SS04 {33}
Martins, Joao ☑	TT3-1 {24}
Martins, João ☑	Dialog 3 {46}
Masic, Semsudin	Dialog 3 {46}
Mastromauro, Rosa Anna	Dialog 3 {46}
Mata, Jorge	SS06 {34}
Mato, Jose L.	SS04 {33}
Matsuo, Syogo	TT5-1 {28}
Maugars, Philippe ☑	TT7 {31}
Mauri, Marco ☑	Dialog 3 {46}
Mazgaj, Witold	Dialog 1 {43}
Mbayed, Rita	Dialog 2 {45}
McGrath, Brendan	TT4-1 {25}
Medeiros, K. P.	SS06 {34}
Mediano, Arturo	TT4-2 {26}
Meier, Marco	SS10 {35}
Meike, Davis	Dialog 3 {46}
Meinguet, Fabien ☑	SS20 {39}
Meizel, Dominique	TT2-4 {24}
Mekri, Fatiha	SS20 {39}
Melo, Guilherme	TT6-2 {30}
Mendes, Marco	IF1 {42}
Meng, Peipei	TT4-6 {27}
Menis, Roberto	Dialog 1 {43}
Mercier, Frederic	TT7 {31}
Mestre, Pascal	SS22 {40}
Meunier, Gérard	TT4-6 {27}
Meyer, Michal	SF1 {48}
Miceli, Rosario ☑	TT4-4 {26}
Michels, Leandro	TT4-6 {27}
Michna, Michal ☑	
Milczarek, Adam	TT6-3 {30}
Minarik, Vladimir ☑	SS07 {35}
Miskiewicz, Rafal	SS16 {38}
Miskowicz, Marek ☑	
Miszewski, Miroslaw ☑	
Miszke, Wiktor	SF1 {48}
Mizoguchi, Takahiro ☑	SS23-2 {41}

Author / attendee	Session ID
Xie, Tiantian	TT3-1 {24}
Xin Xu, Jian	SS22 {40}
Xu, Dehong ☑	TT4-1 {25}
Xu, Jian-Xin ☑	TT5-2 {29}
Xuan, Nguyen Hoa	TT4-5 {27}
Yakoh, Takahiro	TT8-2 {32}
Yamamoto, Akio ☑	TT7 {31}
Yashiro, Daisuke	SS23-2 {41}
Yashiro, Daisuke	SS23-2 {41}
Yokota, Sho ☑	TT5-1 {28}
Yokota, Sho ☑	TT5-1 {28}
Yong, Julien ☑	TT7 {31}
Yu, Hao	TT3-1 {24}
Yu, Xinghuo ☑	TT6-4 {31}
Yu, Xinghuo ☑	TT8-1 {32}
Yuan Chen, Wee ☑	SS22 {40}
Zacharias, Peter	SS11 {36}
Zakis, Janis ☑	
Zambrano, Gabriel ☑	SS12 {36}
Zanasi, Roberto	SS19 {39}
Zare, Firuz ☑	Tutorial 3 {2}
Zawirski, Krzysztof ☑	TT2-1 {22}
Zdanowski, Mariusz	Dialog 1 {43}
Zegaoui, Abdallah	Dialog 3 {46}
Zelechowski, Marcin ☑	Dialog 3 {46}
Zeng, Wente	SS18 {39}
Zerawa, Simon-Alexander ☑	TT1 {22}
Zerawa, Simon-Alexander ☑	TT3-2 {25}
Zermas, Demetris	SF1 {48}
Zhang, Junming	TT4-6 {27}
Zhang, Yao	Dialog 1 {43}
Zheng, Yuanjin	Dialog 1 {43}
Zhou, Erping	TT2-3 {23}
Zhou, Wei	TT4-5 {27}
Zhu, Guchuan	TT1 {22}
Ziani, Aziz Choubail	SS13 {37}
Zimmermann, Horst	Dialog 1 {43}
Zipper, Holger	SS10 {35}
Zoubek, Henning ☑	SS15 {38}
Zunino, Claudio	TT3-1 {24}
Zwanenberg, Victor	TT7 {31}
Zydron, Pawel ☑	Dialog 2 {45}
Zyskowski, Lukasz ☑	Dialog 3 {46}
Zyskowski, Lukasz ☑	IF3 {42}

Index of sessions

Last-minute additions and corrections

Papers added to the schedule

(added to Dialog 2, page 46)

Load Torque Estimation in Sensorless PMSM Drive Using Unscented Kalman Filter ▪ *Dariusz Janiszewski (Poznan University of Technology, Poland)*

Real-Time Control of Drive with Elastic Coupling Based on Motor Position Measured Only ▪ *Dariusz Janiszewski (Poznan University of Technology, Poland)*

(added to Dialog 3, page 47)

Development of an Alert System for Abnormal Systemic Conditions ▪ *Luiz Eduardo Mouta, Marina Curi (Coppe/Ufrj, Brazil), Murilo Nogueira (Plena Transmissioner, Brazil), Mauricio Aredes, Mamour Sop N'Diaye (Coppe/Ufrj, Brazil)*

Performance of Send-on-Delta Sampling Schemes with Prediction ▪ *Kamil Staszek, Sebastian Koryciak, Marek Miskowicz (AGH University of Science and Technology, Kraków, Poland)*

Corrected lists of authors

(correction on page 27)

An Evaluation of 2-phase Charge Pump Topologies with Charge Transfer Switches for Green Mobile Technology ▪ *Yan Chiew Wong, Nurul H. Noordin, Ahmed O. El-Rayis, Nakul Haridas, Ahmet T. Erdogan, Tughrul Arslan (University of Edinburgh, United Kingdom)*

(correction on page 47)

Criteria for Comparison of Energy Efficient Lamps ▪ *Ali M. Eltamaly, A. I. Alolah, Nazar H. Malik, U. Bawah (King Saud University, Saudi Arabia), M. J. Yousef (Saudi Lighting Company)*

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IEEE Catalog Number: CFP11ISI-ART
ISBN: 978-1-4244-9312-8

Towards Safety and Security Critical Communication Systems based on SOA Paradigm

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***Abstract*-Within the last decades concepts and technologies based on Internet Protocol have found their way into domains that long have been the market of proprietary and thus closed telecommunication systems, for example for mission critical purposes. In this context we are witnessing a move towards the merging of circuit-switched voice and packet-switched data networks into a converged network, interconnecting new and existing services in a common infrastructure. This trend was mainly driven by the paradigm of Service-oriented Architecture offering increased efficiency, flexibility and interoperability. Nevertheless safety and security related topics remain, which pose new issues and concerns in this area of research. The authors are convinced that these new issues and concerns need an in-depth analysis and synthesis. Therefore, this paper gives an overview on latest research activities and projects in this area, and states the authors' view on this topic.**

***Keywords*- safety/security, availability, reliability, mission critical communication systems, service-oriented architecture**

I. INTRODUCTION

While changes in modern society consistently alter the equipments and tools we use in our life, we also notice changes to the processes applied in the development of technology itself, seeing them adjusting and perfecting over time. Approaches originally introduced in one field evolve successful in other realms as well and consequently lead to even further advance.

Often misinterpreted and prematurely promoted as silver bullet, Service-oriented Architecture (SOA) still provides a paradigm very useful in the development of systems dealing with today's requirements, especially if those systems are complex in nature or need to consider interoperability and heterogeneity as key features. This paper will show implication regarding safety and security when applying these concepts to a telecommunication system.

SOA is defined by the organization for the advancement of structured information standards (OASIS) as "… *a paradigm for organizing and utilizing distributed capabilities that may be under the control of different ownership domains*"[1, p. 8]. This approach promotes standard based, protocol independent, location transparent, loosely coupled and self-contained services, in which composition of one or more components is obligatory. Such components are communicating via well-defined interfaces and thereby, leave the implementation transparent.

SOA is commonly used in business environments due to substantial cost reductions in planning, deployment and operation of IT projects [2] and with its approach better scalability and manageability can be grasped [3]. One of the contributing factors in the success of SOA is that it is considered as an approach for achieving increased performance and agility [4]. The paradigm used appears to craft an ideal framework for the integration of heterogeneous concepts and technologies.

While in this context terms like platform independence, loose coupling of services, reduced complexity, interoperability, vendor diversity, and scalability might come to mind, this paper will lay its primary focus on safety and security. Developments in the authors' field of research will be described with the specific viewpoint on the challenges faced when using common SOA paradigm.

We will show how the critical process of monitoring services relates to the restrictions applied on safety and security critical communication systems and provide a modified model meeting the raised needs.

II. STATE OF THE ART

SOA uses a standards based approach for development. These standards are classified into several categories mainly service information alternation standards, foundation communications standards and meta-data standards [5]. The commonly accepted functional safety standards include IEC 61508 [6] for hardware and software designers of safety related systems and IEC 61511 [7] which is appropriate for the users of system components. We consider safety which is described for safety critical scopes as "... *the ability of a system not to cause environmentally harming events, due to loss of mission critical information*" [8, p. 1].

For system components like software, quantification of associated risks is not possible. So for quantifying risks associated with software, aerospace, rail and defense sectors identify and design safety processes according to different safety integrity levels (SILs) or development assurance levels

(DALS). They assume that components developed against requirements of SIL levels are less prone to failures and have lower impact on system safety [9]. The reasons for mishaps include incorrect specifications of the system, software errors, common cause failures, human errors and environmental influences. Software safety lifecycle is used to ensure safety for safety critical applications. The usual steps involved in software safety lifecycle [6] are

- Identify hazards and associated requirements.
- Design systems to meet safety requirements.
- Analyze systems that they meet safety requirements.
- Demonstrate safety of the systems by safety cases.

Another consideration is that an absolute level of safety can never be assured so what must be achieved is an acceptable level of safety [10]. Leveson says about safety that if all failures cannot be prevented then it should be ensured that failures that do occur are of minor consequences and even if a serious failure occurs, a system will be fail-safe [11].

Heimdahl mentioned some challenges for safety which include requirement of better methods for safety analysis, improved testing techniques, advance use of runtime monitoring to detect faults and recover to a safe state [12]. Integration of monitoring systems helps in quicker identification of subsystem faults and failures and help to mitigate and prevent failures [13]. Elsewhere it is stated [14] that new failure modes are evolving like denial of service attacks against networked systems and harm to information systems also occurs through removal of service or harming information.

In the authors' viewpoint software safety can be increased through increasing software availability. Increased system availability can be reached through redundancy despite the fact that it is expensive and resources are mostly underutilized with it. Machine virtualization is also a way for achieving reduced system downtime [15] keeping in mind that more machine failures can occur which can result in high resource loss. Diversity is another choice for increasing availability.

For SOA the problems which are seen with respect to availability are that availability is calculated for individual nodes mostly and not from end-to-end perspective and not for the whole architecture [16]. Often applications require the functionality of an enterprise service bus (ESB) like routing and transformation but quality of service attributes including availability for ESB are not handled. Current ESB products provide less data and information on services which is required to verify the status of the service [17]. There are two approaches for measuring availability. One is to calculate it depending on the uptime and downtime of the system during a specific time period and the other is to use historical data. One problem mentioned [18] is that availability guarantees are based on historical data which is not always reliable. It is mentioned in a further research [19] that monitoring systems for their availability is required. Service monitoring is an essential part for service-oriented systems for verifying compliance to service-level agreements, optimizing system performance and minimize costs of hosting [20].

Beside safety, security plays an important role in mission critical communication systems based on SOA paradigm, not only for identifying the communication partners but also to rely on the communication services. In scientific literature, plenty of definitions of security exist but in the most common sense it can be defined as the absence of risks, the greater the risk, the lower the security.

Within this work, the authors consider security which is described for security critical scopes as *"... the protection of assets from threats, where threats are categorized as the potential for abuse of protected assets"* [21, p. 21]. In this context, assets can be seen as information or resources to be protected against attacks. Thus, countermeasures need to be applied to reduce risks to assets. In contrast to safety, security deals with reducing of risks to information or resources from threats whereas particular attention is paid to those kinds of threats resulting from intentional or unintentional misuse. Generally, two domains can be identified when talking about security, namely network or internet security, and system or computer security [22]. As no clear boundaries between these two domains exist, it is immaterial for the authors to consider it within the focus of this paper.

Security critical communication systems not only aim for primary objectives but also for secondary objectives [23]. Primary objectives deal with protecting assets from threats and thus, they can be subsumed by the acronym CIA, a well-known abbreviation for confidentiality, integrity and availability. Secondary objectives deal with authentication and authorization. Detailed information on primary objectives can be found in [24], detailed information on secondary objectives in [25]. Nevertheless, these objectives serve as a basis for deriving adequate security mechanisms and services within the scope of safety and security critical communication systems.

III. SAFETY AND SECURITY

SOA has new and more comprehensive requirements for and recommendation of safety and security due to its distributed hardware and software structure, open and manufacturer-specific (proprietary) interfaces, protocols and formats. These demands will be separately discussed in the next sections.

A. A view on modified SOA model

SOA, commonly referred to as an architectural paradigm and discipline not only for analyzing and designing but also for implementing distributed systems has not only advantages with respect to efficiency, flexibility and interoperability but also disadvantages in terms of safety and security. These considerations are very often ignored, although they play an important role, especially when talking about safety and security critical communication systems for voice and data distribution [8].

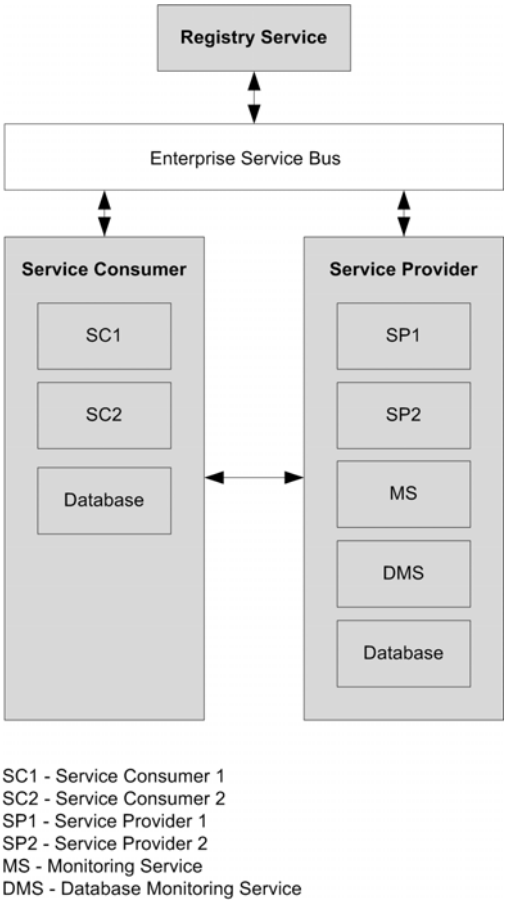

Fig. 1. Modified SOA model

Fig. 1. shows the modified SOA model (consisting of service consumers, service providers and a service registry) which illustrates our point of view. In our model we have two additional monitoring services, one for monitoring service failures and another for monitoring database failures. In addition we are using an enterprise service bus as an optional middleware component for transparency between service providers and service consumers.

B. Safety concerns and issues

Nowadays, consumer demand and dependability on software usage and services has risen by factors and it is an emerging issue to keep safety and availability of services to a certain level which is acceptable by the consumer community as mentioned in Section II.

Non-availability of software modules can be a major reason for reduced safety. The definition of availability by IEEE is "*The degree to which a system or component is operational and accessible when required for use*" [26, p.24]. The definition of basic availability [27] states that system will deliver the correct functionality as long as no failure occurs and no maintenance operations are performed. The authors follow the definition of IEEE and include correctness of response for their own availability definition.

For the authors incorrect service functionality or non-availability of service functionality can result in loss of mission critical information which can reduce system safety. We argue that with high availability of services in SOA a high level of safety comes automatically. A system is considered to be highly available by the authors only if it generates correct output which does not harm the system environment for the given inputs. For the authors if a system produces incorrect output it is not considered as being available and if it is available it will not harm the system. In the opinion of the authors a system can be considered highly available only if risks of failures and faults have been removed from the system which makes the system highly safe in turn too. The authors believe that the opposite case is not true. A system can be highly safe but not highly available because a system can be 100% safe even when it is not operational. The authors focus on improving safety of the system by improving availability of a system.

One safety relevant issue is the non-availability of software modules which can result in incorrect responses, including no responses which can lead to information losses. These losses can put the system in an unsafe system state. To avoid such problems software requirement specification is used by developers which describe software safety requirements like sequence of events, timing constraints and warning interfaces. In this case the safety specification may be incorrect in itself due to the possibility of not including several unknown scenarios. So software for safety critical systems has to fulfill several requirements in order to avoid such problems. It has to go through a software safety lifecycle mentioned in section II for safety assurance. For SOA there is runtime addition and removal of services so it is hard to verify that software safety lifecycle fulfills system safety requirements but still it is very helpful in diagnosing problems before they harm the system environment. The authors also intend to use software safety lifecycle for development of a service-oriented application development environment for their proof of concept.

In SOA, there is a service level agreement (SLA) which describes quality of service parameters like availability and security between communicating parties. For safety critical applications SIL levels are used as described in Section II. In case of safety critical service-oriented applications the authors propose to merge SLA requirements with SIL level quality of service requirements. The authors focus on the application layer for safety analysis of a service-oriented application concentrating on service availability in SOA as for them with higher service availability higher safety can be achieved.

A new concept is proposed, introducing a complete framework for service availability in service-oriented architecture focusing on monitoring service failures and finding optimal service recovery mechanisms like restarting services as shown in Fig. 2.

The key components in the architecture are service consumer, service provider and service registry. Several services are deployed in the setup which can be reached using

diverse protocols. All service providers register their services in a web service registry. All service consumers get access to the services through a middleware which in our case is an enterprise service bus. The task of the enterprise service bus is to make service provider and service consumer transparent to each other by handling the routing and transformation tasks. The service provider registers a service in a service registry. We intend to use a universal description, discovery and integration (UDDI) registry for our setup [28]. There are also other registries which can be used, for instance ebXML which is a registry and repository holding much more information than required for our setup. Using ebXML would mean increased complexity in our solution. An important part of our setup is a monitoring service which handles service health and aliveness by receiving heartbeat messages from the registered services. If a service does not send a heartbeat message within a specific time period it is considered to be dead. The monitoring service then sends an update to the service registry and initiates a failover process. With this process another service provider implementation is used to transparently resume the service for the service consumer. Also a restart of the failed service is initiated by the monitoring service. Monitoring functionality is provided by some ESBs but in our implementation we have our own monitoring service which is independent of the ESB. We consider ESB as a single point of failure for our setup and it is more complex to handle ESB failures than handling monitoring service failures. Moreover the monitoring services which are available with ESBs are not much customizable for our solution. For instance updating a registry server about

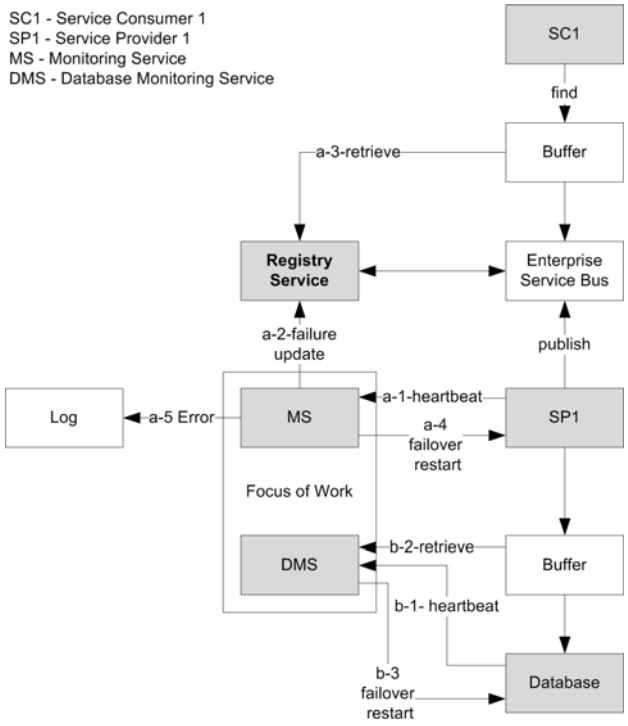

Fig. 2. Safety architecture using monitoring services

service failures and logging the details used in our approach is not provided by ESB monitoring services. We intend to use redundant monitoring services later on in our setup to cover monitoring service failures.

To reduce the possibility of consumer data loss in case of network failures buffers are used to store information which hold consumer request data at several places in the setup. As two monitoring services are used in the setup, one is managing service failures and the other one is monitoring database failures.

All information about failure situations is logged by the monitoring service which could help in failure recovery later on. Automatic IP migration will be used for failover. The proposed approach is different from other approaches as it is a complete solution for a service-oriented setup which can be adopted by safety critical systems for increasing safety and security of system due to use of standards based approach of SOA development. Monitoring service providers in ESB independent way to avoid single points of failure is a different idea.

C. Security concerns and issues

Approaches and best-practices discussed in scientific literature serve as a basis to identify and tackle the given problem spaces of mission critical communication systems. Thus, a lot of frameworks exist, differing not only in terms of functionality and stability but also in terms of performance. Nevertheless, to deal with SOA specific and non-SOA specific threats, vulnerabilities and countermeasures, security has to be implied on several levels.

In the past, security mechanisms concentrate on the transport layer where the security standard Transport Layer Security (TLS) [29] is used [30]. However, problem areas remain for communication systems based on SOA paradigm. TLS only offers point-to-point security instead of end-to-end security which, however, is the requirement for secure message exchange, i.e. the messages are protected only on the transport layer. Therefore, secure message exchange cannot be ensured between the end-systems. In communication systems based on SOA paradigm, messages are sent over several intermediary servers and databases, etc. that may operate on separate elements of these messages. This stated weakness has to be confronted with an integrated solution i.e. security in mission critical communication systems has to be achieved and guaranteed by a framework that reacts to a considerable degree on the varying changes of the environment.

A few security requirements can be met with state-of-the-art approaches and best practices, but many are not yet solved. However, various standards for example eXtensible Markup Language (XML) [31] and WS Security promoted by World Wide Web Consortium (W3C) [32] and Organization for the Advancement of Structured Information Standards (OASIS) [33] exist. Where and how these solutions are applied in communication systems based on SOA paradigm still needs to be discussed.

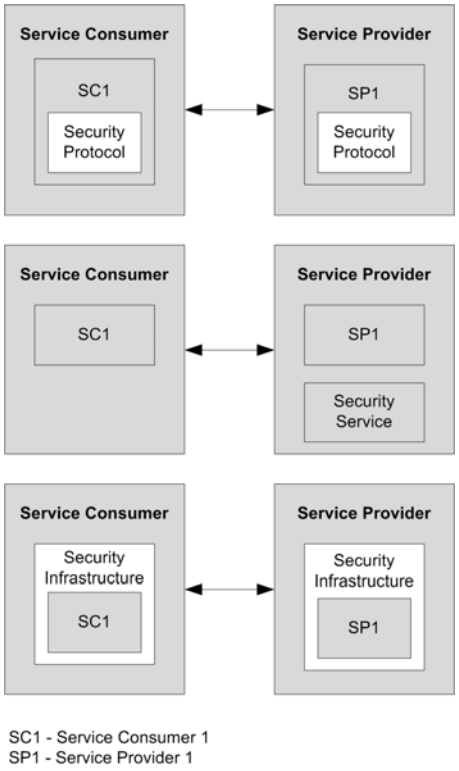

Fig. 3. Security architecture using security services

In the context of this discussion, the authors propose a solution based on the idea that security can only be achieved and guaranteed by security on several levels, depending on the requirements for and recommendation of the service. Thus, the newly proposed security concept adopts, extends and combines the two well-knows security concepts, namely point-to-point and end-to-end. Based on the architectural and environmental scenarios and use-cases it is realized by "security as protocol (standard)", "security as service" and "security as infrastructure", all illustrated in Fig. 3.

In "security as protocol (standard)" the message exchange between service consumers and service providers is achieved by internal means, i.e. security is part of the service whereas in "security as infrastructure" the message exchange between service consumers and service provider is guaranteed by external means, i.e. security is part of the environment. The SOA paradigm is reflected by "security as service" as standard based, protocol independent, location transparent, loosely coupled and self-contained service, offering credentials so that both, service consumers and service providers can securely communicate.

Based on the analysis and design, the implementation of the proposed solution has to be done. Its purpose is not only to show that the newly proposed security concept is different from the two well-known security concepts, namely point-to-point and end-to-end security, but also that it offers an improvement in functionality, performance and scalability. Moreover, it serves as a basis for pointing out the details of the implementation of the proposed solution.

IV. RESULTS

For the implementation of the proposed solution the setup will use Apache Juddi registry server [34] for registration of services. Service providers will use JAXR publish API to publish their service details in the service registry and service consumers will use JAXR inquiry API for finding services from the service registry.

MySQL database server will be used for backend storage for information about services and businesses. The registry server will enforce security through the use of issuance of security tokens. Authentication will be done for every interaction of a service consumer in a session by using the authorization token issued by Juddi registry server. OpenESB which is an implementation of JBI specification will be used. OpenESB is an enterprise service bus which will work as a middleware for routing and transformation of services and will keep service consumers transparent from service providers [35]. OpenESB is based on several open standards for example JBI, Java EE, SOAP, WS and XML standards. Apache Axis will be used as web services deployment platform [36]. Service consumers will interact with ESB using different binding components like uddi-bc for interacting with registry service, http-bc for invoking web services and Db-bc for database access etc.

Several services will be deployed in the simulation environment which will include weather forecast service, notam services (Notice to Airmen) for sending notifications mostly used in aviation services, fuel information service and geo services etc. We will follow software safety life cycle during development to demonstrate safety through different safety cases.

V. CONCLUSION

Although considerable state of the art and related work has been done in the area of safety and security critical communication systems based on SOA paradigm, every application field is setting up different requirements, so that approaches and best-practices cannot fully be applied. This is also the case for the work presented in this paper.

The authors have presented an approach to build mission critical communication systems, taking advantage of SOA paradigm while ensuring safety and security. We introduced an architecture increasing safety by increasing availability, using two independent monitoring services to handle safety critical issues on services and databases. Additionally a solution was proposed based on the idea that security can be achieved and guaranteed by security on several levels, depending on the requirements for and recommendation of a specific service imposed by SOA.

Moving towards services looks promising and the proposed SOA paradigm is a candidate solution. But again, we must not forget that beside all benefits that we get from this new convergence, the quality that is provided to the user has to remain the same, if not increase.

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