SYMPOSIUMS

Symposium on Control in Power Electronics, Electric Drives, Renewable Energy Sources and Smart Grids

11–12 novembre 2022
Centre Scientifique de l'Académie Polonaise des Sciences à Paris

Marcin Morawiec
Gdańsk University of Technology

On October 11-12, 2022, held at the Polish Station of the Polish Academy of Sciences in Paris symposium on the control in power electronics, electric drives, renewable energy sources and smart grids. This meeting was the first inaugural meeting to initiate cyclic events. Therefore, the subtitle of the symposium was "1st Polish-French Symposium on Unconventional Control of Power Electronic Systems and Their Applications". It was devoted to new technologies that have appeared in electrical engineering in recent years and resulted in the development of such specializations as power electronics and electric drives, renewable energy sources, smart grids, electromobility, energy storage and above all hydrogen systems. The organizer of the symposium was PAN in Paris and Gdańsk University of Technology (Gdansk Tech) (Marcin Morawiec, Piotr Musznicki, Roland Ryndzionek, Krzysztof Blecharz, Arkadiusz Lewicki and Jaroslaw Guzinski). The symposium lasted two days. On the first day, a substantive discussion was carried out to highlight current research problems. There were 15 presentations representatives from universities and research laboratories in France as well as from Poland. The welcome speech provides by Magdalena Sajdak from PAN and Marcin Morawiec from Gdansk Tech. The keynote speech prepared prof. Christophe Turpin from Laplace Laboratoire Plasma et Conversion d'Energie about fuel cell systems and ageing mechanisms. The first day was divided into three sessions: 1st about power electronics systems, 2nd about control in electric drives and 3rd about green energy sources and smart grids.

Jaroslaw Guzinski provided the presentation an introduction to the topic of drive systems with multi-phase electric motors. Electric drives with a number of phases greater than 3, i.e. multiphase drives, have a number of advantages. Among them are: greater reliability, smaller current loads of inverter transistors, smaller electromagnetic torque ripple and noise, and finally new control possibilities for the enhancement of the motor torque using higher current and voltage harmonics. The presentation outlined the achievements of the Department of Electric Drives and Energy Conversion, whose team of scientists has been conducting intensive research on multiphase drives for several years. In the department's laboratories, over a dozen five-phase induction and permanent magnet machines were designed and constructed. The research on multiphase machines done by the department team confirmed advantageous properties. The electric drives developed can be used in a wide range of applications, incl. electrical vehicles.

Marcin Morawiec provided the presentation about of using the different observer structures in the sensorless control system of multiphase machines. Roland Ryndzionek provided the speech about design advantages and analysis of a novel five-phase doubly-fed induction generator. The presentation shows the performance analysis of a novel five-phase doubly-fed induction generator (DFIG). The proposed solution aims at extending the range of possible modes of operation of an induction machine generation system. Modern doubly-fed induction generators are a dominating choice for wind energy conversion systems (WECSs).

Piotr Dworakowski provided the presentation about power electronics in medium voltage direct current systems. Medium voltage direct current (MVDC) technology is emerging in electricity networks including point-to-point transmission, distribution networks and collection networks for renewable energy sources. In the presentation, the break-even distance has been introduced according to the overall energy efficiency criteria. Moreover, the DC-DC converters for MVDC electrical networks have been presented and the classification of

DC-DC converters was proposed according to three criteria: power flow directionality, galvanic isolation and modularity.

Piotr Musznicki presented the problem of increased emission of electromagnetic interference in power electronic converters with wide gap transistors, described the mechanisms of their generation and propagation and presented both classical and newest concepts of their mitigation. It has been shown – developed together with a team from G2Elab of Grenoble – an improved shielding method on PCBs, and concepts for creating additional interference propagation internal paths inside the converter.

Pierre-Olivier Jeannin of G2Elab presented problems with the use of GaN transistors, which, due to their very high switching speed are a source of electromagnetic noise. He presented transistor designs and ways of packaging them so as to obtain the lowest possible EMI emissions. Pauline Kergus provided a presentation about the modelling and control methods for energy management.

Krzysztof Blecharz provided the presentation concerning issues related to the design, construction and procedure of laboratory tests of a small counter-rotating wind turbine. The results of simulation and experimental studies presented during the seminar were obtained during the implementation of research and development works as part of a research grant completed at the Gdańsk University of Technology, financed by the WFOŚiGW in Gdańsk. Arkadiusz Lewicki provided the presentation about the potential for DC link voltage balancing and the use of SVPWM algorithms in multi-level CHB inverters. The influence of the H-bridges selection on the accuracy of DC-link voltage balancing and the method of generating an output voltage using space vectors was shown. The presented extended selection method enables firm-grip control of the DC-link voltages.

Maria David-Pietrzak provided the presentation about the sensorless control system of a doubly-fed induction machine by using the dual vector control approach. Nicolas Rouger provided the presentation about recent achievements on power converters, WGB devices and their gate drives.

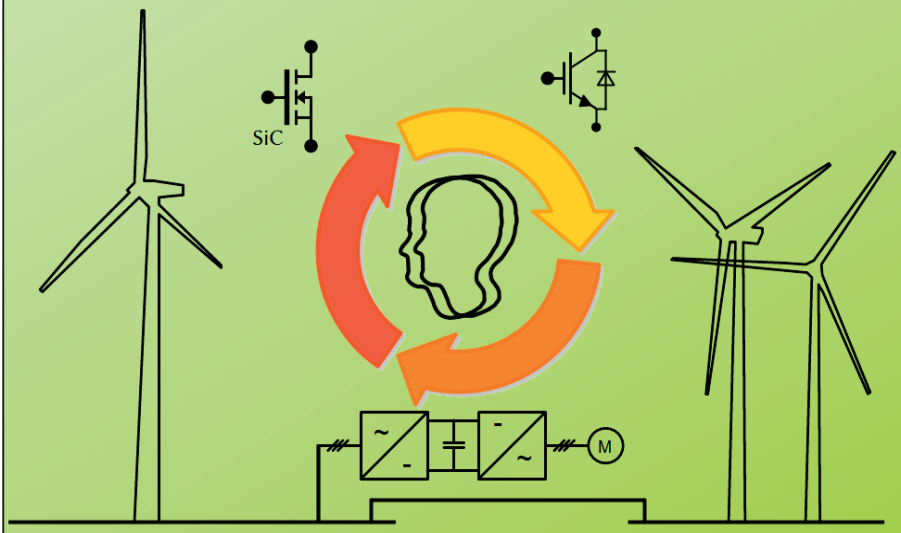
Thierry Meynard provided the presentation about the geometric programming for the design of magnetic components multiplexed inverters for MV drives. Michel Mermet-Guyennet provided a presentation about the energy challenge for trains with onboard energy storage.

On the second day, the keynote speech was presented Prof. Haitham Abu-Rub from Texas A&M University at Qatar about the role of power electronics in creating the futuristic smart energy paradigm. On this day the issue of cooperation in the application of international projects between research centres and the exchange of students and employees for research internships were discussed. Xavier Roboam and Bruno Sareni from Laplace Laboratoire Plasma et Conversion d'Energie presented the recent achievements on smart microgrids integrated design. Piotr Musznicki provided the presentation about the LINTE^2 laboratory.

Renata Downar-Zapolska from Gdansk Tech provided the presentation about the overview of current international grant programs. In the second session of day 2, an open discussion about potential research projects was carried out. The main aim of this symposium successfully achieved. Research teams from France and Poland got to know each other's research topics. Cooperation between them will contribute in a short time to participation in a European research grant.

Symposium on Control in Power Electronics, Electric Drives, Renewable Energy Sources and Smart Grids

1st Polish-French
symposium on unconventional control of power electronics systems
and their application



October 11th - 12th, 2022, Polish Academy of Sciences,
Scientific Center in Paris
74 rue Lauriston 75116 Paris

Organizers:

PAN ACADEMIE POLONAISE DES SCIENCES
Centre Scientifique à Paris
POLISH ACADEMY OF SCIENCES

GDAŃSK UNIVERSITY OF TECHNOLOGY

Fahrenheit Universities

Affiche

PROGRAMME

11/10/2022

09:00-09:15 REGISTRATION

09:15-09:30 WELCOME SPEECH
Magdalena Sajdak (Polish Academy of Sciences Scientific Center in Paris)
Marcin Morawiec (Gdańsk University of Technology)

09:30-10:15 Keynote Speaker: Christophe Turpin (LAPLACE – Laboratoire Plasma et Conversion d'Energie)
Fuel Cell Systems and Aging Mechanisms

10:15-10:30 DISCUSSION

SESSION 1: Power electronics systems
New semiconductor in power electronics, modulation algorithms, new structures of multi-level converters dedicated to the smart-grid application, energy storage, charging systems, and electromobility

10:30-10:45 Nicolas Rouger (LAPLACE – Laboratoire Plasma et Conversion d'Energie) ONLINE
Recent achievements on power converters, WBG devices and their gate drivers

10:45-11:00 Thierry Meynard (LAPLACE – Laboratoire Plasma et Conversion d'Energie)
Geometric Programming for the Design of Magnetic Components/Multiplexed Inverters for MV drives

11:00-11:15 Arkadiusz Lewicki (Gdańsk University of Technology)
SVPWM strategy for multilevel CHB inverter with DC-link voltage balancing capability

11:15-11:30 Piotr Dworakowski (SuperGrid Institute)

Power electronics in medium voltage direct current systems

11:30-11:45 Pierre-Olivier Jeannin (G2ELAB – Grenoble INP)
Packaging Design for Low EMI Generation from Power Modules

11:45-12:00 Piotr Musznicki (Gdańsk University of Technology)
EMI mitigation in the power converters with GaN transistors

12:00-12:15 DISCUSSION

12:15-13:15 LUNCH BREAK

SESSION 2: Control in electric drives
Sensorless control of an electrical machines, regulation systems, genetic algorithms, artificial neural networks

13:15-13:30 Jarosław Guziński (Gdańsk University of Technology)
Multi-phase drives

13:30-13:45 Marcin Morawiec (Gdańsk University of Technology)
Speed observers for five-phase induction machines

13:45-14:00 Roland Ryndzionek (Gdańsk University of Technology)
Five-phase doubly-fed generator

14:00-14:15 Maria David (LAPLACE – Laboratoire Plasma et Conversion d'Energie) ONLINE
Sensorless Dual Vector Control of DFIM Speed Drive

14:15-14:30 DISCUSSION

14:30-15:00 COFFEE BREAK

SESSION 3: Green energy, power management systems, energy storage, hydrogen systems, electromobility

Green energy – energy extraction from renewable sources, hydrogen systems, intelligent smart-girds, electromobility, charging systems

15:00-15:15 Bruno Sareni, Xavier Roboam (LAPLACE – Laboratoire Plasma et Conversion d'Energie) ONLINE
Recent achievements on smart microgrids integrated design

15:15-15:30 Pauline Kergus (LAPLACE – Laboratoire Plasma et Conversion d'Energie) ONLINE
Modeling and control methods for energy management

15:30-15:45 Krzysztof Blecharz (Gdańsk University of Technology)
Small Counter-Rotating Wind Turbine

15:45-16:00 Michel Mermet-Guyennet (Alstom)
Energy challenge for trains with On-Board Energy Storage

16:00-16:15 Mickael Petit (CNAM; ENS-Paris-Saclay; CNRS)
Modelling a redefined architecture for concentrated photovoltaic power plant

16:15-16:30 DISCUSSION

12/10/2022

09:00-09:15 REGISTRATION

09:15-10:15 Haitham Abu-Rub (Texas A&M University at Qatar) ONLINE
The Role of Power Electronics in Creating the Futuristic Smart Energy Paradigm

SESSION 1: Presentation of the research teams and research units

10:15-11:15	LAPLACE Research Laboratory – main topics and facilities Piotr Musznicki (Linte2; Gdańsk University of Technology) Piotr Dworakowski (R&D projects; SuperGrid Institute)
11:15-11:45	COFFEE BREAK
11:45-12:45	Renata Downar-Zapolska (Gdańsk University of Technology) ONLINE Overview of current international grant programs: – EU Framework Programs HORIZON EUROPE, – Welcome to Poland – NAWA program. Horizon Europe research and innovation programs (2021-2027): – ERC Starting Grant 2022, – ERC Consolidator Grant 2022, – ERC Advanced Grant 2022, – other programs.
12:45-13:45	LUNCH BREAK

SESSION 2: Proposal of the potential research project and other cooperation

13:45-14:45	Jarosław Guziński (Gdańsk University of Technology) Magdalena Sajdak (Polish Academy of Sciences – Scientific Centre in Paris) Open discussion about potential research project in the future