Industrial Electronics for Better Life!

32nd International Symposium on Industrial Electronics

Aalto University, Helsinki-Espoo, Finland,
June 19th - June 21st, 2023

in cooperation
Message from the General and Program Chairs

Dear delegates and authors of the IEEE International Symposium on Industrial Electronics 2023 (ISIE 2023), welcome to Finland in mid-summer! This time, the 32nd edition of ISIE is hosted by the Aalto University, a relatively young institution, but with more than 100 years of history.

The slogan of this ISIE 2023 is “Industrial Electronics for Better Life”. This implies many things: cleaner, safer, healthier, and merrier life. The Industrial Electronics Society of IEEE is at the very centre for technology innovation that aims achieving these goals. We are at the forefront of energy transition, sustainable manufacturing, intelligent automation and robotics, artificial intelligence, smarter cities, and digital health.

ISIE 2023 attempts to fully return to the onsite mode, without online presentations. During the COVID time we have changed our habits to the online mode of teaching and presenting. While it is convenient, we lose the enjoyment of the live communication. That is why we insisted on live presentations this time, to help the community return to the normal mode of operation and accelerate our progress.

The Industrial Electronics Society works hard on continuously improving the quality of its conferences. One way to achieve that is to nurture scientific communities behind technical tracks, to continue from edition to edition. Technical Program Committees stand behind all ISIE Technical Tracks. Their members provided thorough reviews and selection of papers.

Technical committees of IES played great role in this edition of ISIE having led the technical tracks and contributing to track program committees.

The conference offers a very vibrant technical and social program. There are four keynote talks by great speakers from both industry and academia. Besides, there are two industry forum sessions and industrial exhibitions. The students and young professional forum
on Monday will give the stage to the future of our society, students, young engineers and researchers who will talk about their current research and development challenges.

Last but not least, we would like to thank all reviewers who have dedicated time to assess and ensure that the papers in the conference are of high quality. The ISIE 2023 conference provides an opportunity to experience the vibrant (but still relaxed) capital of Finland and feel the spirit and culture of this country, voted the world’s happiest nation many times in a row. We do hope you will spend four exciting days in Helsinki and Espoo!

**General Chairs:** Valeriy Vyatkin¹, Milos Manic², Roberto Oboe³ and Juan Jose Rodriguez-Andina⁴;

**Technical Program Chairs:** Mahdi Pourakbari-Kasmaei⁵, Wenbin Dai⁶, Lucia Lo Bello⁷, Michael Ruderman⁸ and Yang Shi⁹

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General information

OFFICIAL LANGUAGE
Presentation and conference activities will be conducted in English language. In the capital area of Helsinki-Espoo one can expect most of the local residents to be able to understand and speak English. Do not hesitate to ask for help if you are lost!

CURRENCY
The currency in Finland is Euro.

CONFERENCE LOCATION
The conference location is the Aalto University at the following address: Otakaari 1, 02150, Espoo, Finland. The closest metro station is Aalto University (Exit A).

WIRELESS INTERNET ACCESS
There is “aalto open” network freely available to the Aalto University visitors. Another option is to use the “eduroam” network if you have the corresponding account from your institute. For wireless connectivity outside of the campus one can purchase SIM card of a local operator. R-Kioski is the shop where SIM cards are sold, they exist in airport, on campus, central station and scattered around the city.

REGISTRATION
The registration desk is located in the central hall right near the building main entrance. Registration will be open from 8:00 (Monday 8:30) in the morning till 18:00 in the evening.

NAME BADGES
Please wear your name badges at all times to allow entry to all the sessions and coffee breaks. You will find dinner ticket in your delegate package.

PROCEEDINGS
Conference proceedings will be available for download in advance via a web-link. No USB dongles will be provided.

PRESENTATION INSTRUCTIONS
Please prepare presentation slides in Powerpoint and upload to the presentation computer before your session (either using USB drive, or download from your private repository). The presentation time is 15 minutes, and 5 more minutes is allocated to questions and change of the presenter.

TIME ZONE
The time zone in Finland currently is Eastern European Summer Time (EEST), which is UTC+3.
ISIE 2023 Organising committee

HONORARY CHAIRS
- Toshio Fukuda, Japan
- Heikki Koivo, Finland
- Kim Fung Man, Hong Kong
- Maria Valla, Argentina

GENERAL CHAIRS
- Milos Manic, USA
- Roberto Oboe, Italy
- Juan Jose Rodriguez-Andina, Spain
- Valeriy Vyatkin, Sweden/Finland

TECHNICAL PROGRAM CHAIRS
- Wenbin Dai, China
- Lucia Lo Bello, Italy
- Mahdi Pourakbari, Finland
- Michael Ruderman, Norway
- Yang Shi, Canada

SPECIAL SESSIONS CHAIRS
- Gabor Sziebig, Norway
- Larisa Dunai, Spain

TUTORIAL AND WORKSHOP CHAIRS
- Marina Indri, Italy
- Morgan Kiani, USA

PUBLICATION CHAIRS
- Udayanto Dwi Atmojo, Finland
- Antonio Luque, Spain

FINANCE CHAIRS
- Peter Palensky, Netherlands
- Seppo Sierla, Finland

WEB AND PUBLICITY CHAIRS
- Magda Janeiro, Finland
- Sandeep Patil, Sweden
- Chen-Wei Yang, Sweden

INDUSTRY CHAIRS
- Tommi Karhela, Finland
- Michael Condry, USA
- Toni Mattila, Finland
- Raine Viitala, Finland

STUDENT & YOUNG PROFESSIONALS (S&YP) FORUM CHAIR
- Marek Jasinski, Poland

EXHIBITION CHAIRS
- Seppo Borenius, Finland
- Tuomo Lindh, Finland
- Seppo Sierla, Finland
- Kari Tammi, Finland
- Raine Viitala, Finland

LOCAL ORGANISING COMMITTEE
- Anu Randén-Siippainen, Finland
- Mikhail Kolesnikov, Finland
- Tuojian Lyu, Finland
- Pranay Jhunjhunwala, Finland
- Rakshith Subramanya, Finland
- Ilkka Seilonen, Finland
Program at glance

Monday through Wednesday lunches will be served in the Dipoli building, Room Sief. Monday 11:30-13:00, Tuesday and Wednesday 11:30-13:30. To avoid queues, delegates are advised to have lunch outside of the midday peak hour. Coffee Breaks are in the second floor hall of the conference site 10:30-11:00 and 15:30-16:00.

MONDAY
Registration desk open 08:30-18.00.
Tutorials: 09:00-10:45
Sessions: 09:00-10:45, 11:00-12:00 and 16:00-18:00
Students and Young Professionals forum 09:30-12:30, Hall B.
Opening session: 13:10-13:30
Welcome Reception at Hanasaari Hotel 19:00

TUESDAY
Registration desk opens at 08:00
Industry visits (book in advance at the registration desk): 09:00-12:00.
Sessions: 09:00-10:45, 14:30-15:30 and 16:00-18:00
Keynote talk 2a: “The intelligent automation experience” by Rikard Franz, Head of development department of Processing Automation, Tetra Pak, Sweden, 11:00-12:00, Hall A (Aalto).
Keynote talk 2b: “The digital twin: The why and the how” by Alexander Fay, Professor and Head of the Institute of Automation Technology, Helmut Schmidt University, Germany. 13:30-14:30, Hall A (Aalto).
Gala dinner: 19:00 at Pikku Finlandia, Helsinki
https://2023.ieee-isie.org/gala-dinner

WEDNESDAY
Registration desk opens at 08:00
Industry visits (book in advance at the registration desk): 09:00-12:00.
Sessions: 09:00-10:45, 14:30-15:30 and 16:00-18:00
Keynote 3: “Industry 4.0 on Shoestring: The Case for Low-Cost Digitalisation?” by Duncan McFarlane, Professor of Industrial Information Engineering / Head of Distributed Information & Automation Lab, University of Cambridge, UK, 13:30-14:30, Hall A (Aalto).
Closing ceremony: 17:40-18:00, Hall A (Aalto).
<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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<tbody>
<tr>
<td>09:00</td>
<td>TC Meeting - Electrical Machines</td>
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<tr>
<td>09:00</td>
<td>Tutorial 1 - State Space based Control as an Alternative to Conventional Loop Design in Power Converters</td>
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<tr>
<td>09:00</td>
<td>Tutorial 2 - Multi-phase Electrical Drives: New outlook and expectation from the Industries</td>
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<td>09:00</td>
<td>Tutorial 3 - Advanced optimal feedforward torque control and operation management of electrical drives</td>
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<td>09:00</td>
<td>Tutorial 4 - Multiple Active Bridge Converters for flexible DC grids</td>
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<td>09:15</td>
<td>Tutorial 5 - Information Processing for Industrial Cyber-physical Systems - A Complex Systems Science Approach</td>
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<td>09:30</td>
<td>IEEE IES SYP (Student and Young Professionals)</td>
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<td>10:00</td>
<td>Coffee</td>
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<td>10:30</td>
<td>IEEE IES SYP (Student and Young Professionals Forum)</td>
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<tr>
<td>11:00</td>
<td>TT 03-1 - Power Systems and the Smart Grid, Renewable Energy Systems and Smart Grid Systems</td>
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<td>11:00</td>
<td>TT 02-1 - Electric Energy Storage</td>
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<td>11:00</td>
<td>SS 02-2 &amp; WIP Machine Vision</td>
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<td>11:00</td>
<td>TT 12-1 - ICT and AI Enabling Smart Cities, Buildings, Agriculture, Informatics, Manufacturing, Medicine, Engineering, and Industrial Plants</td>
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<tr>
<td>11:00</td>
<td>TT 04-1 - Electrical Machines and Drives</td>
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<td>11:30</td>
<td>Lunch</td>
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<td>12:00</td>
<td>Opening Ceremony</td>
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<tr>
<td>13:30</td>
<td>Keynote - Liana Ault</td>
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<td>TT 03-2 - Power Systems and the Smart Grid, Renewable Energy Systems and Smart Grid Systems</td>
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<td>TT 02-2 - Electric Energy Storage</td>
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<td>16:00</td>
<td>TT 04-2 - Electrical Machines and Drives</td>
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<tr>
<td>16:00</td>
<td>TT 11-2 - Human Centric ICT Enabling Smart Medicine, Assitive Robotics, Security, Education and Ethics</td>
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<td>16:00</td>
<td>WIP TT 10-2 - Industrial Informatics: Cloud Computing, Big Data, AI, Informatics and Software Engineering</td>
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<tr>
<td>16:00</td>
<td>TT 13-2 - Human Centric ICT Enabling Smart Medicine, Assitive Robotics, Security, Education and Ethics</td>
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<td>16:00</td>
<td>SS 13-1</td>
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<tr>
<td>16:00</td>
<td>TT 04-3 - Electrical Machines and Drives</td>
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<tr>
<td>16:30</td>
<td>Welcoming Reception</td>
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**Monday 19, June 2023**
<table>
<thead>
<tr>
<th>Time</th>
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<tr>
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<tr>
<td>11:00</td>
<td>Lunch</td>
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<tr>
<td>11:30</td>
<td>Workshop 1: Artificial Intelligence and Information Security</td>
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<tr>
<td>12:00</td>
<td>Workshop 2: Future Grids and Energy</td>
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<tr>
<td>12:30</td>
<td>Lunch</td>
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<tr>
<td>13:00</td>
<td>Workshop 3: Smart Cities and Transportation</td>
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<td>13:30</td>
<td>Lunch</td>
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<tr>
<td>14:00</td>
<td>Workshop 4: Smart Grid and Renewable Energy</td>
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<td>14:30</td>
<td>Lunch</td>
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<tr>
<td>15:00</td>
<td>Workshop 5: Smart Manufacturing and Digitalization</td>
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<td>15:30</td>
<td>Lunch</td>
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<tr>
<td>16:00</td>
<td>Workshop 6: Smart Agriculture and Food Technology</td>
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<tr>
<td>16:30</td>
<td>Lunch</td>
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<tr>
<td>17:00</td>
<td>Workshop 7: Smart Robotics and Internet of Things</td>
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<td>17:30</td>
<td>Lunch</td>
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<tr>
<td>18:00</td>
<td>Workshop 8: Smart Grid and Energy</td>
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<td>18:30</td>
<td>Lunch</td>
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<td>19:00</td>
<td>Gala Dinner</td>
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<td>Coffee</td>
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<td>Coffee</td>
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<tr>
<td>21:00</td>
<td>Gala Dinner</td>
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Sessions at a Glance:

- **TUESDAY 20, JUNE 2023**
- **IEEE IES**
- **Fay Franz**
# Sessions at a Glance

**Wednesday 21, June 2023**

<table>
<thead>
<tr>
<th>Time</th>
<th>Hall</th>
<th>Event</th>
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<tbody>
<tr>
<td>09:00 - 12:00</td>
<td>A</td>
<td>IEEE IES Strategy Workshop</td>
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<tr>
<td>09:00 - 10:45</td>
<td>B</td>
<td>Power Electronics &amp; Energy Conversion Workshop</td>
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<tr>
<td>11:00 - 12:00</td>
<td>C</td>
<td>Industrial Informatics: Cloud Computing, Big Data, AI, Informatics and Software Engineering</td>
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<tr>
<td>09:00 - 10:30</td>
<td>A</td>
<td>TT 03-6 &amp; WIP: Power Systems and the Smart Grid</td>
</tr>
<tr>
<td>09:00 - 10:30</td>
<td>B</td>
<td>TT 08-1: Instrumentation, Sensors, Actuators, Systems Integration and Nano-Technology</td>
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<tr>
<td>11:00 - 12:00</td>
<td>B</td>
<td>TT 05-9: Power Electronics &amp; Energy Conversion Workshop</td>
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<tr>
<td>11:00 - 12:00</td>
<td>C</td>
<td>TT 10-6: Industrial Informatics: Cloud Computing, Big Data, AI, Informatics and Software Engineering</td>
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<tr>
<td>11:00 - 12:00</td>
<td>A</td>
<td>TT 04-6: Instrumentation, Sensors, Actuators, Systems Integration and Nano-Technology</td>
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<tr>
<td>11:30 - 13:30</td>
<td>A</td>
<td>Lunch / Coffee / Evening Event / Workshop</td>
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<tr>
<td>13:30 - 14:15</td>
<td>A</td>
<td>Keynote - Duncan McFarlane</td>
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<tr>
<td>14:00 - 15:45</td>
<td>A</td>
<td>Industry Forum</td>
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<td>16:00 - 17:40</td>
<td>A</td>
<td>WIP TT 05-10: Instrumentation, Sensors, Actuators, Systems Integration and Nano-Technology</td>
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<td>15:00 - 16:00</td>
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<tr>
<td>16:00 - 18:00</td>
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<td>IEEE IES Strategy Workshop</td>
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<td>16:00 - 17:30</td>
<td>A</td>
<td>WIP TT 13-3: Electric Energy Storage</td>
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<td>16:00 - 17:30</td>
<td>B</td>
<td>TT 02-3: Electric Energy Storage</td>
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<tr>
<td>16:00 - 17:30</td>
<td>C</td>
<td>SS 08-2: Cloud Computing, Big Data, AI, Informatics and Software Engineering</td>
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<tr>
<td>17:40 - 18:00</td>
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Keynote talks

KEYNOTE 1

REAL TIME DATA, PRIVACY, PROFIT, AND THE DISTRIBUTED GRID

Liana Jo Ault
Venture General Manager for Energy Innovation, Nokia, UK

Abstract:
In this topic we will investigate how distributed generation has changed the way we use data. We will discuss the impact privacy and profit have on the use of our data, the pitfalls and successes of existing solutions and challenges yet to be resolved.

Speaker Bio:
Liana is a Venture General Manager for Energy Innovation at Nokia. Leading a new Nokia venture focused on digital platforms supporting optimization of flexible and renewable assets, her team focuses on commercialization in start-up environment.

Liana has extensive experience working with power utilities and industrial customers on new business models and industry trends. She likes to ask ‘What If?’ and is passionate about encouraging the next generation of sustainable engineers to challenge the status quo, ask the tough questions and find new innovative solutions.

KEYNOTE 2

THE INTELLIGENT AUTOMATION EXPERIENCE

Rikard Franz
Head of development department of Processing Automation, Tetra Pak, Sweden

Abstract:
Over the years, automation has improved performance in most production sites in the world and is actually seen as the 3rd revolution in the industry. The addition of the digitalization, has further improved the value of automation. As most people are currently wondering about how to make the best use of this we are thinking of how we can make the journey easier for people working with these solutions.

How can we make life easier for operators, maintenance people and managers. We have to add a new level to automation solutions, where things like UX and UI, linked to artificial intelligence will even further enhance the operations at production sites. Also, how can we make sure that Cyber Security threats does not put an abrupt end to this journey.

Speaker Bio:
With a long experience in Process Automation and manufacturing, Rikard is now heading the development department of Processing Automation at Tetra Pak, being an expert in plant control, monitoring, and automation services. After finalizing his master’s degree at Lund University, Rikard started to work with Automation as a programmer. Over the years, various positions in Project Management, automation sales and management has taken Rikard to the senior expert position he is having today.

KEYNOTE 3

INDUSTRY 4.0 ON SHOESTRING: THE CASE FOR LOW-COST DIGITALISATION?

Duncan McFarlane
Professor of Industrial Information Engineering / Head of Distributed Information & Automation Lab, University of Cambridge, UK

Abstract:
This talk will review the original intent of Industry 4.0 and some of its limitations when being applied in small companies. A systematic template for supporting digitalisation for small manufacturers will be presented and the Digital Manufacturing on a Shoestring programme introduced as a means of addressing key aspects of this template. The key features of the Shoestring programme will be presented along with results of numerous developments and deployments in the last 2-3 years. Future industrial developments and research challenges in this area will be presented.
**Speaker Bio:**
Duncan McFarlane is Professor of Industrial Information Engineering at the University of Cambridge and Head of Distributed Information & Automation Lab and a visiting Professor at University of Melbourne. He began his career as an engineering cadet with BHP in Melbourne and has worked in the industrial automation area for over 25 years joining Cambridge in 1995. He was Research Director of the Auto ID Centre in 2000-3 and subsequently co-founder and Chairman of RedBite Solutions Ltd - an industrial RFID/IoT based asset management solutions company. He is Principal Investigator on the Digital Manufacturing on a Shoestring programme developing low cost digital solutions for small manufacturers with more recent spin-outs into construction, logistics and medical systems. The Shoestring approach is currently being rolled-out with SMEs across several regions in the UK and overseas. From March to July 2020 he led a team which won the RAE Presidents Award for providing Industrial Engineering support to local hospitals managing the Covid-19 Epidemic and from September 2020 to July 2021 was Operations Logistics lead at Cambridge University for its Asymptomatic Covid-19 Student Testing Programme.

**Speaker Bio:**
Alexander Fay (IEEE Member’02, Senior Member ‘07) is Full Professor and Head of the Institute of Automation Technology at the Helmut-Schmidt-University in Hamburg, Germany. His main research interests are models and methods for the engineering of large automated systems, especially in the process and manufacturing industries, in buildings and transportation systems. With his research team, he develops and employs knowledge-based methods, ontologies, autonomous systems and other AI techniques. The aim of his team is to develop models, methods and tools to increase engineering efficiency and to assist in the engineering and operation of industrial plants. He is member of the Scientific Board of the German Society for Measurement and Automation (GMA) and Head of its Department “Methods of Automation”. He was a member of the IEEE Industrial Electronics Society Administration Committee between 2009 and 2011. Between 2009 and 2017, he served as an Associate Editor of IEEE Transactions on Industrial Informatics. Alexander Fay is a member of acatech, the German Academy of Engineering Sciences. Since 2014, he has been a member of the Scientific Advisory Board and of the WG 2 “Research and Innovation” of the German “Industrie 4.0” initiative.

**Keynote 4**

**The Digital Twin: The Why and The How**

Alexander Fay  
Professor and Head of the Institute of Automation Technology, Helmut Schmidt University, Germany

**Abstract:**  
Digital Twins have gained increasing interest during the last years. Various concepts and technologies exist for the implementation of Digital Twins, and their possible applications are multifold. Beyond promising perspectives, companies long for advice where they should start with applying Digital Twins: should they build Digital Twins to support their development processes, or their production? Or rather Digital Twins of their products, for better maintenance and update services? Should they restrict access to these Digital Twins to own staff, or can Digital Twins offer new perspectives also for their customers? Furthermore, Digital Twins will be gamechangers for lifecycle services. New business opportunities arise, and thus, new players. Who will be the owner of the Digital Twin and the data it comprises and generates? Which capabilities are required to make use out of it? How will this change the value chain of engineering and operation of systems in production, logistics, transport and energy distribution? These questions are the subject of this keynote, and methods how to find answers, individually for one’s business: How to position in future in the value chain, how to identify attractive applications of the Digital Twin, how to identify which information is required to set up a Digital Twin, and how to make best use of standards and existing information.
Maps

FLOOR 1

FLOOR 2

FLOOR 3

FLOOR 4
Industry Forum and Exhibition

SESSION 1
MONDAY, JUNE 19TH

Time: 14:30 - 15:30
Session Chair: Seppo Borenius

<table>
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<th>Time</th>
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<th>Company</th>
<th>Title</th>
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<tr>
<td>14:30-14:50</td>
<td>Mikko Heikkilä</td>
<td>Beckhoff Automation</td>
<td>The importance of services in the success of automation product development projects</td>
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<tr>
<td>14:50-15:10</td>
<td>Mika Skarp</td>
<td>Cumucore Oy</td>
<td>Software defined factory - requirements to industrial communication infrastructure</td>
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<tr>
<td>15:10-15:30</td>
<td>Greg Boucaud</td>
<td>Universal Automation. Org</td>
<td>Unleashing industry 4.0 thanks to hardware independent automation apps</td>
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SESSION 2
WEDNESDAY, JUNE 21ST

Time: 14:30 - 15:30
Session Chair: Raine Viitala

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<th>Time</th>
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<th>Company</th>
<th>Title</th>
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<tr>
<td>14:30-14:50</td>
<td>Jouni Aro</td>
<td>Prosys OPC Ltd</td>
<td>OPC UA based data harmonization</td>
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<tr>
<td>14:50-15:10</td>
<td>Gerardo Santillan</td>
<td>Semantum Oy</td>
<td>Experiences with industrial interoperability standards and Model Broker</td>
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<tr>
<td>15:10-15:30</td>
<td>Veikka Pirhonen</td>
<td>Siemens</td>
<td>Energy Flexibility Management - Platform, Solutions and Services</td>
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In this tutorial, a unified theory for generic loss minimization by optimal feedforward torque control (OFTC) of electrical machines is presented which allows to analytically compute (i) the optimal direct and quadrature reference currents for all operating strategies, such as MTPC, MC, FW, MTPV (or MTPF), and, in particular, Maximum Torque per Losses (MTPL, minimizing copper & iron losses), (ii) the transition points indicating when to switch between the operating strategies due to speed, voltage and/or current constraints. The unified theory is applicable for all operation modes and allows to consider copper and iron losses and arbitrary machine nonlinearities. The analytical solutions allow for an (almost) instantaneous selection of the actual operation strategy and the computation of its corresponding optimal reference currents. Numerical methods (approximating these solutions only) are no longer required. All optimization problems, their respective constraints, and the computation of the intersection point(s) of voltage ellipse, current circle, or torque, MTPL, MTPC, MTPV, MTPF hyperbolas are reformulated implicitly as quadrics (quadratic surfaces). The proposed theory is suitable for any electrical machine. Most recent results are presented which utilize artificial neural networks (ANN) which allow to solve the OFTC problem also analytically but even faster.

Since most dc/dc power stages for computer or telecom applications are currently optimized as modules by manufacturers, the effort in development moves towards controller implementation. While conventional feedback control design methods in frequency domain (lead-lag, or PI-D) are well mastered in industry, with numerous digital or power IC implementation options, this tutorial proposes and demonstrates a major leap forward with the use of State Space based design. The tutorial demonstrates that a State Space based controller is physically equivalent to a series cascaded control set up with an outer voltage loop and an inner either peak or average current loop. An in-depth presentation of the method’s actual simplicity, rich in worked examples for either analog or digital implementation, opens this topic to any introductory to intermediate audience.

Multiple-Active-Bridge converters are an interesting device to interlink several sources/sinks or busses within complex power networks. For instance, they could be used in solid state transformers or More Electric Aircraft DC-microgrids. However, modeling and control are more difficult than for the dual active bridge due to the more complex structure. Thus, this tutorial aims to guide attendees through the build process of an impedance model of a quadruple-active bridge converter and the related control. Attendees will learn how to derive the mathematical model of the converter and how to implement the control.
Multi-phase motor drive systems have attracted much attention in recent years due to some inherent advantages which they offer when compared to the three-phase counterpart. The new developments in areas such as electric ship propulsion, more-electric aircraft, electric and hybrid electric vehicles, electric locomotive traction and renewable electric energy generation has invoked the interest amongst the researchers. These applications invariably require the electric machine, which is traditionally a three-phase motor. The multi-phase machines with power electronic based converters along with advanced control strategies are creating niche technological advancement to improve reliability and energy efficiency of these energy conversion systems. This tutorial provides new outlook and expectation from the industrial point of view.

**Y313 Tutorial 7 Z-Source DC Solid-State Circuit Breakers**

**Monday, 19 June 2023, 09:00-10:30**

Organizer(s) and Presenter(s): Fang Peng, FAMU-FSU College of Engineering, US, Keith Corzine, University of California Santa Cruz, US, Jinyeong Moon, FAMU-FSU College of Engineering, US

Dc power systems have become extremely popular as compared to ac systems due to a reduction in power conversion steps required and elimination of low-frequency transformers. Examples of dc microgrids include ship power and propulsion systems, renewable energy power systems, computer data centers, aircraft power and drivetrains, etc. In the dc microgrid, all components are well defined except for the dc circuit breaker. Options include using oversized ac breakers, solid-state dc breakers, and hybrid breakers. This tutorial covers the Z-source dc circuit breaker which is a variation of the solid-state circuit breaker. The Z-source breaker was first introduced in 2010 at ISIE. It features a resonant Z-source impedance network which causes the source current to go to zero in response to a low-impedance fault. Since its introduction, many researchers have presented variations on the Z-source breaker including broad technical improvements, bi-directional versions, etc. This tutorial summarizes this Z-source breaker research. It will first review the fundamental Z-source circuits introduced approximately 15 years ago, including the coupled inductor Z-source circuits and utilization of the circuits in the Z-source inverter. Subsequently, the fundamental Z-source breaker idea will be described, followed by a number of variations on the Z-source breaker, including bi-directional topologies. Finally, incorporating the Z-source breaker within DC-DC power converters will be presented. Selected examples of Z-source breakers will be utilized throughout the tutorial to illustrate various practical concepts, with simulations of these examples being made available to the tutorial participants.


**Monday, 19 June 2023, 09:00-10:30**

Organizer(s) and Presenter(s): Alex Norta, Tallinn University, Estonia Vimal Dwivedi, University of Tartu, Estonia and Queens University, Belfast, UK, Raimundas Matulevius, University of Tartu, Estonia Mubashar Iqbal, University of Tartu, Estonia

The tutorial will cover the intersection of blockchain DApp development, artificial intelligence (AI), and cyber security. It is offered to academic researchers, practicing engineers, and professionals in the industry who want to learn about the latest advances in these three areas and how they can be combined to create cutting-edge solutions. The fundamental concepts of blockchain, DApps, AI and cyber security will be introduced, explaining how these technologies work and how they can be integrated to build secure and efficient systems. The tutorial will delve also into the practical aspects of developing blockchain DApps with AI and cyber security will be introduced, explaining how these technologies work and how they can be integrated to build secure and efficient systems. The tutorial will delve also into the practical aspects of developing blockchain DApps with AI and cyber security, discussing the challenges of integrating AI into blockchain DApps and how to overcome them. It will explore the best practices for ensuring the cyber security of blockchain DApps and how to avoid common security pitfalls. Real-world examples and case studies will be used throughout the tutorial to illustrate concepts and techniques.
Artificial Intelligence (AI) is coming of age. It is gradually becoming embedded in industrial systems and settings. Following several decades of expedient development and adoption of Artificial Narrow Intelligence (ANI); an intelligence that is domain-specific and requires technical operating expertise, we are now witnessing the rise of Artificial General Intelligence (AGI), in what is termed generative AI. Although these early developments of generative AI are far from the original definition of AGI, they represent a paradigm shift in the intelligence of machines, a transition from narrow to general. This disruptive force of AI is manifested in the current wave of Generative AI models, such as ChatGPT, LLaMA, Bard and Sparrow. ChatGPT is the fastest-growing consumer application in human history, reaching a hundred million active users just two months after its launch. In this tutorial, participants will learn the theory and practice of using generative AI models and libraries for the development of industrial applications and solutions. The tutorial begins by exploring the structural elements of Generative AI models, transformers, hyper-parameters, transfer learning and comparison to standard machine learning algorithms, followed by the application of generative AI for the design, development and evaluation of industrial applications. Participants will develop hands-on skills in using generative AI libraries and acquire a practical understanding of “prompt engineering” for diverse industrial settings. The learning outcomes of this workshop are; the theoretical foundations of Generative AI when to use and in which settings, the design and development of Generative AI models, prompt engineering for diverse use cases and rapid prototyping to evaluation of a suitable Generative AI solution.

Requirements:
Participants will access Google Collaboratory using a Gmail account. A laptop with an Internet browser and a stable Internet connection is mandatory.

C Hall TT 05-1 Power Electronics & Energy Conversion
Monday, 19 June 2023, 09:00-10:45
Chairs: Christoph Hackl, Sertac Bayhan

PAPERS
09:00-09:20
ISIE23-000026 Analysis and Modeling of Switched-Capacitor Converters with Parasitic Inductance
Yuhang Yang, Zheng Dengke, Ranyu Yao, Yan Deng

09:20-09:40
ISIE23-000040 Artificial Neural Network Based Thermal Model for a Three-Phase Medium Frequency Transformer
David Molinero, Daniel Santamargarita, Emilio Bueno, Marta Marrón, Miroslav Vasic

09:40-10:00
ISIE23-000043 Three-phase EV Charging System Based on Matrix Converters with Improved Current Commutation
Yuxin Liu, Wusen Wang, Rundong Huang, Senyi Liu, Hao Wen, Chunhua Liu

10:00-10:20
ISIE23-000044 A Novel Sensorless Control Method for Three-Phase Active Front End Rectifiers
Ali Sharida, Haitham Abu-Rub, Sertac Bayhan

10:20-10:40
ISIE23-000367 Fuzzy Inferenced Impedance Matching for the SIMO-WPT Scheme
Jamie Yang, Chun-Liang Lin

Y307 Tutorial 5 Information Processing for Industrial Cyber-physical Systems - A Complex Systems Science Approach
Monday, 19 June 2023, 09:15-10:45
Organizer(s) and Presenter(s): Pedro H. J. Nardelli, Lappeenranta-Lahti University of Technology, Finland, Daniel G. Rojas, Lappeenranta-Lahti University of Technology, Finland, Nicola Marchetti, Trinity College Dublin, Ireland, Harun Siljak, Trinity College Dublin, Ireland, Indrakshi Dey, Walton Institute for Information and Communications Science, Ireland

Agent based modelling (ABM) is a method of implementing computational models for a collection of relatively autonomous and
heterogeneous nodes, whose behavior can be defined with a limited number of simple rules. ABM can account for a massive number of communicating nodes with a potentially infinite number of physical and logical interactions between them. However, ABM always looks for a realistic way to define interactions among the nodes, and we can indeed consider the agents as part of a given cyberphysical system (CPS) characterized by three constitutive layers. If both nodes and links are considered as agents, each of them will have their own behavioral pattern and will provide information about the dynamics of the formed network. Agent-based models can also characterize interactions between the heterogeneous agents and generate effects like clustering, coalition, communication or opportunistic resource access. Using the network effects generated, the analysis of Industrial CPSs based on ABM has the potential of establishing itself as one of the most efficient tools for extracting network topologies using physical, functional and resource-based inter-relationships between the agents at much lower complexity and energy requirements than either ML-based techniques or traditional statistical modelling. This tutorial will present a detailed theoretical conceptualization of the application of ABM for modelling the dynamics of industrial CPSs, and enabling information processing and decision-making. It will serve as a key knowledge-transfer tool for mitigating the risks of the cyber-enabled dynamics that are reaching several domains like energy and infrastructure, construction and manufacturing industries, and transportation.

**B Hall IEEE IES SYP (Student and Young Professional)**

**Monday, 19 June 2023, 09:30-10:30**

**Chairs:** Pranay Jhunjhunwala, Edivan Laercio Carvalho

**PAPERS**

**9:30-9:35**

Welcome Words from IES SYP-AC  
Pranay Jhunjhunwala, Edivan Laercio Carvalho

**9:35-10:00**

Keynote 1: Edivan Laercio Carvalho

**10:00-10:05**

MQLINK: A Scalable and Robust Communication Network for Autonomous Drone Swarms  
Wen Chun Huang

**10:05-10:10**

Capacitive Sensor-based Smart Water Tap: A Feasibility Study  
Kazi Jabed Akram

**10:10-10:15**

Fruit Detection and Classification Using Computer Vision and Machine Learning Techniques  
Víctor Zárate

**10:15-10:20**

Attack prevention and detection for cyber-physical systems based on coprime factorization technique  
Shimeng wu

**10:20-10:25**

On LinDistFlow Model Congestion Pricing: Bounding the Changes in Power Tariff  
Shourya Bose

**Coffee break**

**Monday, 19 June 2023, 10:30-11:00**

**Y405 TT 04-1 Electrical Machines and Drives**

**Monday, 19 June 2023, 11:00-12:00**

**Chairs:** Claude Delpha, Yannick Karekezi

**PAPERS**

**11:00-11:20**

ISIE23-000004 Stator Intermittent Ground Fault Detection in High-Impedance Grounded Generators  
Nader Safari-Shad, Russ Franklin

**11:20-11:40**

ISIE23-000020 Development of High Voltage Switched Reluctance Starter/Generator System for More Electric Aircraft  
Yang Chenyi, Shoujun Song, ChaoYang Liu, JiXi Zhong, Sun Guilin
11:40–12:00
ISIE23-000027 A Novel Indicator-Based Online Diagnosis Technique of Inter-Turn Short Circuit Faults in Asymmetrical Six-Phase Induction Machines, Adopting a Model Predictive Controller
Khaled Laadjal, João Serra, Antonio J. Marques Cardoso

Y228a SS 02-1 Machine Vision
Monday, 19 June 2023, 11:00–12:00
Chairs: Ahmad Hably, Huei-Yung Lin

PAPERS
11:00–11:20
ISIE23-000075 Online Object Tracking on Multiple Cameras with Completely Overlapping Views
Jan-Philip Richter, Sebastian Flores, Oliver Urbann

11:20–11:40
ISIE23-000086 Design and characterization of an EOG signal acquisition system based on the programming of saccadic movement routines
Alfredo Frem, Monica Valenzuela Delgado, Wendy Flores-Fuentes, Julio Rodriguez, Oleg Sergiyenko, daniel Hernandez-Balbuena, Fabian N. Murrieta-Rico, Jesus Miranda-Vega, Paolo Mercorelli

11:40–12:00
ISIE23-000334 Using object detection for a robust SLAM in dynamic environments
Youssef EL GAOUTI, Fouad Khenfri, Mehdi Mcharek, Cherif Larouci

C Hall TT 05-2 Power Electronics & Energy Conversion
Monday, 19 June 2023, 11:00–12:00
Chairs: David Molinero, Arun Nrayanan

PAPERS
11:00–11:20
ISIE23-000045 A generic Lyapunov-based Observer for Double-Star-Chopper-Cell/Bridge-Cell Modular-Multilevel-Cascade-Converters
Leonardo Testa, Oliver Kalmbach, Christoph M. Hackl

11:20–11:40
ISIE23-000047 Mitigation of Current Ringing Effects in a Dual Active Bridge Converter
Alfonso Damiano, Giuseppe Bossi, Mauro Boi, Andrea Floris

11:40–12:00
ISIE23-000065 Motion Control by Wireless Transmission of Power Packets: Experimental Verification with Multi-finger Robot Hand
Takahiro Mamiya, Shiu Mochiyama, Takashi Hikihara

M240 TT 03-1 Power Systems and the Smart Grid, Renewable Energy Systems and Smart Grid
Monday, 19 June 2023, 11:00–12:00
Chairs: Bruno de Oliveira e Sousa, Christoph Hackl

PAPERS
11:00–11:20
ISIE23-000078 A Predictive Control based Scheme for Maximum Power Extraction of PMSG based Wind Turbine Systems
fahimeh shiravani, Jose Antonio Cortajarena, Patxi Alkorta, Mikel Gonzalez Perez, Oscar Barambones

11:20–11:40
ISIE23-000099 Reinforcement Learning based Coordination of Virtual Inertia Provision from Inverter-dominated Distribution Grids
Simon Stock, Davood Babazadeh, Philipp Hund, Christian Becker

11:40–12:00
ISIE23-000008 The choice of components for the construction of a power inverter of 44 kW WPT system
Jakub Škorvaga, Michal Frivaldsky

Y229c WIP TT 07-1
Monday, 19 June 2023, 11:00–12:00
Chairs: Gabor Sziebig

PAPERS
11:00–11:20
ISIE23-000360 Fuel Economy Simulation and Development of an Online Data Acquisition System with HIL Method for a VW Crafter Hybrid Car
Peter Szemes
<table>
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<tr>
<th>Time</th>
<th>Session</th>
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</table>
| 11:20-11:40  | ISIE23-000389 Compensating Delays for Precise and Real-time ROS Cloud Robotics Localization
Gábor Fehér, Norbert Reider, Marcell Balogh, Dániel Ágocs, Dániel Rózsa |
| 11:40-12:00  | ISIE23-000098 A user-extensible solution for deploying fog computing in industrial applications
Pietro d'Agostino, Massimo Violante, Gianpaolo Macario |

**Y313 TT 11-1 Intelligent Factory Automation**

**Monday, 19 June 2023, 11:00-12:00**

**Chairs:** Chen-Wei Yang

**PAPERS**

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<th>Time</th>
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</table>
| 11:00-11:20  | ISIE23-000025 Evaluation of Isolation and Communication Mechanisms for Real-Time Containers
Moritz Walker, Marc Fischer, Armin Lechler, Alexander Verl |
Sergio de López, Roberto Martín López, Emilio José Bueno Peña, Francisco Javier Rodríguez Sánchez |
| 11:40-12:00  | ISIE23-000118 Component Test - Test Strategies with Asset Administration Shells
Dirk Schöttke, Stephan Schäfer, Thomas Kämpfe, Vasil Denkov, Aaron Zielstorf |

**Y346 TT 13-1 Human Centric ICT Enabling Smart Medicine, Assistive Robotics, Security, Education and Ethics**

**Monday, 19 June 2023, 11:00-12:00**

**Chairs:** Larisa Dunai, Jinhua She

**PAPERS**

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<th>Time</th>
<th>Paper</th>
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</table>
| 11:00-11:20  | ISIE23-000140 Effective Severity Assessment of Parkinson’s Dis-ease with Wearable Intelligence using Free-living Environment Data
Liu Tao, Xulong Wang, Fengtao Nan, Jun Qi, Yun Yang, Po Yang |
| 11:20-11:40  | ISIE23-000226 Presentation of Underwater Sensation by Drag in Knee Motion with a Lower Limb Exoskeleton Using MR Fluid Brakes
Ryunosuke Sawahashi, Taiki Masuda, Taiga Shimizu, Rie Nishihama, Manabu Okui, Taro Nakamura |

**Y307a TT 10-1 Industrial Informatics: Cloud Computing, Big Data, AI, Informatics and Software Engineering**

**Monday, 19 June 2023, 11:00-12:00**

**Chairs:** Seiichiro Katsu, Polina Ovsianikova

**PAPERS**

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<th>Time</th>
<th>Paper</th>
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</table>
| 11:00-11:20  | ISIE23-000033 Temporal bi-index
Michal Kvet |
| 11:20-11:40  | ISIE23-000041 Application of reinforcement learning for energy consumption optimization of district heating system
Jifei Deng, Miro Eklund, Seppo Sierla, Jouni Savolainen, Hannu Niemistö, Tommi Karhela, Valeriy Vyatkin |

**B Hall IEEE IES SYP (Student and Young Professional Forum)**

**Monday, 19 June 2023, 11:00-12:30**

**Chairs:** Pranay Jhunjhunwala, Edivan Laercio Carvalho

**PAPERS**

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<th>Time</th>
<th>Paper</th>
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</table>
| 11:00-11:05  | Extending Edge-Based Mobile Robot Navigation with Social Awareness
Marcell Balogh |
| 11:05-11:10  | Fault-Tolerant Active Neutral-Point-Clamped Multilevel Inverter Maintaining Output Voltage at Failure
Jun Hitokuwata |
Liana has extensive experience working with power utilities and industrial customers on new business models and industry trends. She likes to ask ‘What if?’ and is passionate about encouraging the next generation of sustainable engineers to challenge the status quo, ask the tough questions and find new innovative solutions.

**C Hall TT 05-3 Power Electronics & Energy Conversion**

**Monday, 19 June 2023, 14:30-15:30**

**Chairs:** Oscar Lucia, Khaled Laadjal

**PAPERS**

**14:30-14:50**

ISIE23-000066 Analysis and Mitigation of Low-Order-Harmonic Neutral-Point Voltage and Current Ripples in Five-Level NPC-Based Inverters  
ALMACHIUS KAHWA, Hidemine Obara, Yasutaka Fujimoto

**14:50-15:10**

ISIE23-000070 Load-Independent Class E-1 Voltage-Driven Synchronous Rectifier  
Shizuna Oshima, Hirotaka Koizumi

**15:10-15:30**

ISIE23-000076 Passive Damping Stabilization for Constant-Power Loaded Boost Converter  
Max Sebastià-Rullo, Angel Cid-Pastor, Hugo Valderrama-Blavi, Abdelali El Aroudi, Luis Martinez-Salamero

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**A Hall Keynote 1 - Liana Jo Ault**

**Monday, 19 June 2023, 13:30-14:30**

**Keynote 1:** Real time data, privacy, profit, and the distributed grid  
Liana Jo Ault  
Venture General Manager for Energy Innovation, Nokia, UK

**Abstract:**
In this topic we will investigate how distributed generation has changed the way we use data. We will discuss the impact privacy and profit have on the use of our data, the pitfalls and successes of existing solutions and challenges yet to be resolved.

**Speaker Bio:**
Liana is a Venture General Manager for Energy Innovation at Nokia. Leading a new Nokia venture focused on digital platforms supporting optimization of flexible and renewable assets, her team focuses on commercialization in start-up environment.
Experiences with industrial interoperability standards and Model Broker
Gerardo Santillan, Senior Specialist and Sales Manager, Semantum Oy

Energy Flexibility Management - Platform, Solutions and Services
Veikka Pirhonen, Director, Energy Flexibility Management, Siemens

Coffee break
Monday, 19 June 2023, 15:30-16:00

Y229a TT 12-1 ICT and AI
Enabling Smart Cities, Buildings, Transport, Agriculture, Energy Efficiency and Sustainability
Monday, 19 June 2023, 16:00-17:00
Chairs: Kim Fung Tsang, Haibo Cheng

PAPERS
16:00-16:20
ISIE23-000298 An Efficient and Secure DAG-based LoRaWAN System
Yang WEI, Kim Fung Tsang, Hao Wang

16:20-16:40
ISIE23-000005 Artificial Intelligence-Based Diagnosis of Hydraulic Centrifugal Pumps Using Vibration Sensor: Feature Extraction and Failure Classification
Zahra Kazemi, Peter Rindom Andersen, Jakob Lemming, Peter Gorm Larsen

16:40-17:00
ISIE23-000103 PestDSS: An Integrated Decision Support System for Sustainable Pest Management in Agriculture
Zhipeng Yuan, Ruolin Peng, Daniel Laybourne, Shunbao Li, Po Yang, Yang Li

Y405 TT 04-2 Electrical Machines and Drives
Monday, 19 June 2023, 16:00-18:00
Chairs: Firdausa Ahmed, Marko Hinkkanen

PAPERS
16:00-16:20
ISIE23-000029 Segmentation Effects in the Modular HVDC Offshore Wind Generator and its Impact on Losses
Yannick Karekezi

16:20-16:40
ISIE23-000071 Nonlinear Three-Phase Reluctance Synchronous Machine Modeling With Extended Torque Equation
Johannes Roßmann, Niklas Monzen, Maarten Kamper, Christoph M. Hackl

16:40-17:00
ISIE23-000073 A Coupled Electromagnetic-thermal Dynamic Model for Wind Turbine Permanent Magnet Synchronous Generator Operation Analysis
Aras Ghafour, Siniša Djurović, Judith Apsley

17:00-17:20
ISIE23-000113 Multiparameter Estimation Accuracy Improvement for PMSMs Using a Constriction Coefficient-Based Particle Swarm Optimization
Sana Etemadi, Hongfu Cheng, Mohammad Sedigh Touibi, Uday Deshpande, Narayan Kar

17:20-17:40
ISIE23-000129 A simple disturbance observer for stator flux linkage estimation of nonlinear synchronous machines
Niklas Monzen, Bernd Pfeifer, Christoph M. Hackl

17:40-18:00
ISIE23-000130 Artificial neural network based optimal feedforward torque control of electrically excited synchronous machines
Niklas Monzen, Christoph M. Hackl

Y307 TT 09-1
Monday, 19 June 2023, 16:00-18:00
Chairs: Alin Tisan, Marta Marron-Romera

PAPERS
16:00-16:20
ISIE23-000011 Bag-of-Functions Denoising: Extracting main components in time series
Hendrik Klopries, Andreas Schwung

16:20-16:40
ISIE23-000097 Age Group Recognizer based on Human Face Supporting Smart Digital Advertising Platforms
Adri Priadana, Muhamad Dwisnanto Putro, Duy-Linh Nguyen, Xuan-Thuy Vo, Kanghyun Jo
16:40-17:00
ISIE23-000110 A Noninvasive Smart Chair System for Monitoring Postures in Sedentary Workers
Luis Sigcha, Eduarda Pereira, Ana Lima, João Tiago Antunes, Diana Carvalhais, Diogo Sousa, Abdulay Abreu, Nelson Costa, Paulo Cardoso

17:00-17:20
ISIE23-000114 Gaze orientation to evaluate object interaction in human functional assessment
Álvaro Nieva Suárez, Marta Marrón Romera, Cristina Losada Gutiérrez

17:20-17:40
ISIE23-000183 ARTriViT: Automatic Face Recognition System Using ViT-Based Siamese Neural Networks with a Triplet Loss Mustaqeem Mustaqeem, Muhammad Saeed, Abdulmotaleb Elsadik, Wall Guealeb

17:40-18:00
ISIE23-000184 Semantic-Based Image Steganography with Deep Convolutional Network Fangfang Liu, Sicheng Wang, Yang Yang, Lunan Sun

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E Hall TT 03-2 Power Systems and the Smart Grid, Renewable Energy Systems and Smart Grid

Monday, 19 June 2023, 16:00-18:00
Chairs: Bruno de Oliveira e Sousa, Christoph Hackl

PAPERS

16:00-16:20
ISIE23-000009 Hardware-in-the-loop modeling of three-phase T-type neutral point clamped voltage source inverter for battery charging stations
Kristián Takács, Michal Frivaldsky

16:20-16:40
ISIE23-000035 Combining virtual synchronous machine and feedforward torque control for doubly-fed induction machine based wind energy conversion systems
Andre Thommessen, Christoph Hackl

16:40-17:00
ISIE23-000067 Three-level four-leg Voltage Source Inverter modulation techniques comparison for smart grids
Asier Davila, Iñaki Aizpuru, Estefania Planas, Jose Antonio Cortajarena, Antoni Arias

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Y228a SS 02-2 & WIP Machine Vision

Monday, 19 June 2023, 16:00-18:00
Chairs: Danilo Caceres Hernández

PAPERS

16:00-16:20
ISIE23-000275 Numerical Algorithm for Processing Phase Images for Measuring Three-Dimensional Geometry of Dynamic Objects by Phase Triangulation Methods
Sergey Dvoynishnikov, Vladimir Pavlov, Grigory Bakakin, Dmitriy Kulikov, Vladimir Meledin, Vitaly Rakhmanov

16:20-16:40
ISIE23-000276 Application of narrowband optical filtering of Doppler signals in aerodynamic and hydrodynamic experiments
Vitaly Rakhmanov, Sergey Dvoynishnikov, Grigory Bakakin, Vladimir Pavlov

16:40-17:00
ISIE23-000315 A Robust Self-Organizing UAV Swarm with Loss Compensation Strategies for Efficient Mission Execution

17:00-17:20
ISIE23-000377 Autonomous Drone Swarm with Bionic Control

17:20-17:40
ISIE23-000366 An Image Location System Based on SIFT Algorithm to Alternative to GPS
Zi-Ming WANG, Chun-Liang Lin
17:40-18:00
ISIE23-000087 Fruit Detection and Classification Using Computer Vision and Machine Learning Techniques
Víctor Zárate, Ednita Gonzalez, Danilo Cáceres-Hernández

Y347 SS 13-1
Monday, 19 June 2023, 16:00-18:00
Chairs: Zaixin Song, Chunhua Liu

PAPERS
16:00-16:20
ISIE23-000069 Deadbeat-Direct Complex Torque Control for Permanent Magnet Synchronous Motors
Wusen Wang, Yuxin Liu, Bowen Zhang, Hao Wen, Feng Yu, Chunhua Liu

16:20-16:40
ISIE23-000089 Design of A Novel Dual Three-Phase Dual Stator Axial Flux Permanent Magnet Machine with Mechanical Offset
Rundong Huang, Bowen Zhang, Zaixin Song, Yuxin Liu, Yong Chen, Chunhua Liu

16:40-17:00
ISIE23-000091 Power Quality Disturbance Identification Algorithm Based on Empirical Wavelet Transform And Time-Domain Kurtosis Feature Analysis
Chi Zhang, Yizhi Zhu, Caityang Yu, Jiawei Bao, Qingsong Wang, Giuseppe Buja

17:00-17:20
ISIE23-000117 Improved Predictive Control for Dual Motors Drives with Phase Angle Regulation
Yong Chen, Rundong Huang, Hao Wen, Bowen Zhang, Zaixin Song, Chunhua Liu

17:20-17:40
ISIE23-000128 Comparison and Performance of Five-Phase SVPWM Overmodulation Strategies
Feifei Bu, Beijia Ma, Ya Qin, Peng Li, Qi Liu, Sorin Ioan Deaconu

17:40-18:00
ISIE23-000156 Common-Mode Voltage Reduction-Based Space Vector Modulation Strategy for Three-Phase Two-Level Inverter with Delta-Connected Loads
Zhiping Dong, Hao Wen, Tianci Wang, Bowen Zhang, Zaixin Song, Chunhua Liu

C Hall TT 05-4 Power Electronics & Energy Conversion
Monday, 19 June 2023, 16:00-18:00
Chairs: Khaled Laadjal

PAPERS
16:00-16:20
ISIE23-000090 Combined Operation of CCM and DCM for an Active Buffer DAB AC-DC Converter
Kain Arai, Shohei Komeda, Shunsuke Takuma, Yoshiya Ohnuma

16:20-16:40
ISIE23-000092 A Low Passive Count Redundant Four-Level Inverter Topology
Fernanda Vejar, Martin März

16:40-17:00
ISIE23-000100 Multifunctional Grid-Forming Cascade Control for Converters Equipped with an LCL Filter
Rayane Mourouvin, Tuure Nurminen, Marko Hinkkanen, Ville Pirsto, Jarno Kukkola

17:00-17:20
ISIE23-000101 A novelty proposal of Grid-Forming Multi-Cell DC-AC Converter for Single-Phase Railway Catenary Systems
Roberto Martín López, Alessandro Faro, Sergio de López, Alessandro Lidozzi, Emilio Bueno

M240 TT 02-1 Electric Energy Storage
Monday, 19 June 2023, 16:00-18:00
Chairs: Arun Nrayanan, Luca Tendera

PAPERS
16:00-16:20
ISIE23-000168 An Extension of the Kinetic Battery Model for Optimal Control Applications
Masoomeh Karami, Sajad Shahsavari, Eero Immonen, Mohammad-Hashem Haghbayan, Juha Plosila

16:20-16:40
ISIE23-000215 Design of a Thermal Battery Dummy with Integrated Sensor Node
Michael Grubmüller, Bernhard Schweighofer, Hannes Wegleiter

16:40-17:00
ISIE23-000212 Degradation Detection of Series-Connected Li-ion based ESS via Time Domain Reflectometry
Hyeong Min Lee, Yong-June Shin
17:00-17:20
ISIE23-000202 Three-Dimensional Model of a cylindrical Lithium-Ion Cell - Influence of Cell Design on State Imbalances and Fast-Charging Capability
Alexander Fill, Mike Kopp, Jessica Hemmerling, Sabri Baazouzi, Luca Tendaer, Kai Peter Birke

Y229c TT 07-2
Monday, 19 June 2023, 16:00-18:00
Chairs: Sertac Bayhan, Jiarui Zhang

PAPERS

16:00-16:20
ISIE23-000122 A Resilient Framework for 5G-Edge-Connected UAVs based on Switching Edge-MPC and Onboard-PID Control
Gerasimos Damigos, Achilleas Santi Seisa, Sumeet Gajanan Satpute, George Nikolakopoulos, Tore Lindgren

16:20-16:40
ISIE23-000134 Discrete-time Observers for a Mechatronics System with PID Controllers Tuned Using SMA
Alexandra-Iulia Szedlak-Stinean, Radu-Emil Precup, Raul-Cristian ROMAN, Emil Petriu

16:40-17:00
ISIE23-000137 Dynamic path planning in human-shared environments for low-resource mobile agents
Pangcheng David Cen Cheng, Marina Indri, Federico Maresca, Antonio Ragazzo, Fiorella Sibona

17:00-17:20
ISIE23-000139 PI and Super Twisting Sliding Mode with Smith Predictor Control Structures for SMA Actuators
Claudia-Adina Bojan-Dragos, Radu-Emil Precup, Raul-Cristian ROMAN, Emil M. Petriu, Mihai Muntyan

17:20-17:40
ISIE23-000151 Angle Control Using Corona Discharge Considering Voltage Range Limitations
Shigeki Yashita, Hiroaki Katagiri, Tomoya Kitamura, Yuki Inada, Yutaka Kazoe, Takahiro Nozaki

17:40-18:00
ISIE23-000387 MQLINK: A Scalable and Robust Communication Network for Autonomous Drone Swarms

Y313 TT 11-2
Monday, 19 June 2023, 16:00-18:00
Chairs: Alexander Fay, Yingyue Zhang

PAPERS

16:00-16:20
ISIE23-000200 Deep Q-Learning versus Proximal Policy Optimization: Performance Comparison in a Material Sorting Task
Reuf Kozlica, Stefan Wegenkittl, Simon Hirländer

16:20-16:40
ISIE23-000240 Free Software and Open-Source Hardware for Industrial Automation
Balakrishna Balakrishna, Ivan Tyagov, Sven Franck

16:40-17:00
ISIE23-000271 A Semantic Model to Express Process Parameters and their Interdependencies in Manufacturing
Tom Jeleniewski, Hamied Nabizada, Jonathan Reif, Aljosha Köcher, Alexander Fay

17:00-17:20
ISIE23-000290 A Methodology for Integrating Asset Administration Shells and Multi-agent Systems
Lucas Sakurada, Fernando De la Prieta, Paulo Leitao

17:20-17:40
ISIE23-000295 Contract-Based Design for Low-Code Development in Industrial Edge Applications
Deyuan Qu, YINGYUE ZHANG, Xiaoyu Hu, Wenbin Dai

17:40-18:00
Qiuyue Wang, YINGYUE ZHANG, Qinyun Hu, Xiao Wu, Wenbin Dai
**Y307a WIP TT 10-2 Industrial Informatics: Cloud Computing, Big Data, AI, Informatics and Software Engineering**

**Monday, 19 June 2023, 16:00-18:00**

**Chairs:** Luis Gomes, Sandeep Patil

**PAPERS**

16:00-16:20
ISIE23-000241 Reliability Estimation of Split DNN Models for Distributed Computing in IoT Systems
Juan David Guerrero Balaguera, Ian A. Harshbarger, Josie Esteban Rodriguez Condia, Marco Levorato, Matteo Sonza Reorda

16:20-16:40
ISIE23-000368 Developing a Test Suite for Evaluating IEC 61499 Application Portability
Midhun Xavier, Tatiana Liakh, Sandeep Patil, Valeriy Vyatkin

16:40-17:00
ISIE23-000384 Hardware support for Static-Priority Stack Resource Policy based scheduling
Per Lindgren, Pawel Dzialo, Henri Lunnikivi

17:00-17:20
ISIE23-000393 Unified Digital Framework in Marine Applications
Cristiane Gonzaga, Hanna Kujawska, Bruno de Oliveira e Sousa

17:20-17:40
ISIE23-000398 Analysing navigation paths in constrained graphs using Petri nets
Luis Gomes, Jose Ribeiro-Gomes

17:40-18:00
ISIE23-000399 Supporting a .csv-based Workflow in MongoDB for Data Analysts
Matteo Fresta, Alessio Capello, Francesco Bellotti, Luca Lazzaroni, Marianna Cossu, Riccardo Berta

**Y346 TT 13-2 Human Centric ICT Enabling Smart Medicine, Assistive Robotics, Security, Education and Ethics**

**Monday, 19 June 2023, 16:00-18:00**

**Chairs:** Larisa Dunai, Jinhua She

**PAPERS**

16:00-16:20
ISIE23-000231 Artificial-Voice-Based Conversational Lecture Video Clips for Flipped Classroom
Kazuhiro Umetani, Yoshitaka Toyota, Masataka Ishihara, Eiji Hiraki

16:20-16:40
ISIE23-000303 An Explainable Artificial Intelligence Approach for Force Estimation from Surface-EMG Using the Element Description Method
Daiki Sodenaga, Issei Takeuchi, Seiichiro Katsura

16:40-17:00
ISIE23-000333 Analysis of Latent Factors Affecting Video Game Performance Using Machine Learning Methods
Julia Orlova, Anton Stepanov, Anton Vinogradov, Lubov Orlova, Anna Baldycheva, Andrey Somov

17:00-17:20
ISIE23-000347 Design and Preliminary Evaluation of a Virtual Reality with Haptic Feedback Tool for Spatial Neglect Assessment and Rehabilitation
Mohamed Guiatni

17:20-17:40
ISIE23-000371 Non-contact Physiological Monitor Based Fuzzy Control for Treadmill
Pei-Chun Hung, Yu-Chen Liu, Chun-Liang Lin, Wen Chun Huang

**Welcoming reception**

**Monday, 19 June 2023, 19:00-21:00**

Conference Welcoming Reception at Hanasaari Restaurant (Hanasaarenranta 5, 02100 Espoo).

Dress code: Business Casual
## SESSIONS

### Y405 TT 04-3
**Tuesday, 20 June 2023, 09:00-10:30**  
**Chairs:** Claude DELPHA, Firdausa Ahmed  

### PAPERS

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<tr>
<th>Time</th>
<th>Paper Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>09:00-09:20</td>
<td>ISIE23-000135 Fault Severity Estimation in 7-Phase Electrical Machines in a Noisy Environment</td>
<td>Lu ZHANG, Claude DELPHA, Demba DIALLO</td>
</tr>
<tr>
<td>09:20-09:40</td>
<td>ISIE23-000147 Hybrid Encoderless Control of Multi-Salient Induction Motors in Parallel Connection at Variable Flux and Torque</td>
<td>Eduardo Rodriguez Montero, Markus Vogelsberger, Thomas Wolbank</td>
</tr>
<tr>
<td>09:40-10:00</td>
<td>ISIE23-000150 Modelling a Rotor Bar of an Induction Motor for Improving Electromagnetic Torque and Efficiency Using Permeance-Based Equivalent Circuit Model and FEA</td>
<td>Areej Fatima, Omolbanin Taqavi, Ze Li, Glenn Byczynski, Narayan Kar</td>
</tr>
<tr>
<td>10:00-10:20</td>
<td>ISIE23-000157 Design and Analysis of A Highly Integrated Wireless Motor Drive System</td>
<td>xingyu liu</td>
</tr>
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</table>

### Y347 TC Meeting - ESoC
**Tuesday, 20 June 2023, 09:00-10:30**

### Y313 TT 11-3 & WIP TT 11
**Tuesday, 20 June 2023, 09:00-10:30**  
**Chairs:** Wenbin Dai, Haibo Cheng  

### PAPERS

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<tr>
<th>Time</th>
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</thead>
<tbody>
<tr>
<td>09:00-09:20</td>
<td>ISIE23-000401 Modeling Energy Consumption of Industrial Processes with Seq2Seq Machine Learning</td>
<td>Simon Howind, Thilo Sauter</td>
</tr>
<tr>
<td>09:20-09:40</td>
<td>ISIE23-000299 Automatic Microservice Orchestration and Deployment Method Based On the Modular Type Package for Industrial Edge Applications</td>
<td>Jiale Kang, Xiao Wu, huiwen wu, Dali Yang, Wenbin Dai</td>
</tr>
</tbody>
</table>

### 09:40-10:00
ISIE23-000316 Improving the Execution Time of Industrial Applications through Planned Cache Eviction Policy Selection  
Sergio Arribas Garcia, Giovani Gracioli, Marco Caccamo, Tomasz Kloda, Denis Hoornaert

### 10:00-10:20
ISIE23-000307 Collective Learning for Energy-centric Flexible Job Shop Scheduling  
Arun Narayanan, Evangelos Pournaras, Pedro Nardelli

### Y346 TC Meeting - Cluster 4
**Tuesday, 20 June 2023, 09:00-10:30**

### Y307 TT 07-3 Motion Control, Robotics and Mechatronics
**Tuesday, 20 June 2023, 09:00-10:45**  
**Chairs:** Mihoko Niitsuma, Chung-Ta King  

### PAPERS

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<thead>
<tr>
<th>Time</th>
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<tbody>
<tr>
<td>09:00-09:20</td>
<td>ISIE23-000166 Motion Planning of Fly-wing UAVs for Autonomous Landing in Crosswind</td>
<td>Pengyuan Shao, Yanfei Dong, Jian Tan</td>
</tr>
<tr>
<td>09:20-09:40</td>
<td>ISIE23-000176 Development of Automatically Controlled Facial Osteotomy Robot using Force Information - For Safe Le Fort I Osteotomy -</td>
<td>Koji Niwa, Kazuki Yane, Yusuke Kido, Tomoya Kitamura, Takahiro Nozaki</td>
</tr>
<tr>
<td>09:40-10:00</td>
<td>ISIE23-000182 A Performance-Adaptive and Time-Monitored Autonomous Ticket Booking Service in Cloud</td>
<td>Hongyun Liu, Maarten Oudejans, Ruyue Xin, Paola Grosso, Zhiming Zhao</td>
</tr>
<tr>
<td>10:00-10:20</td>
<td>ISIE23-000193 Proposal of a Method for Measuring Inside Diameter of Tubes Using a Drive Unit of a Robot for Inspection of Small Tubes</td>
<td>Hiroto Nagashima, Kosuke Uchiyama, Fumio Ito, Manabu Okui, Taro Nakamura</td>
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TUESDAY
20 JUNE 2023

10:20-10:40
ISIE23-000306 Distributed Formation Control and Dynamic Formation Transformation for Multi-vehicle Systems based on Virtual Leader-Follower Structure and Triggered Strategy
Bohan Liu, bing yan

Y229a TT 01-1 New Technologies for Electric Transportation
Tuesday, 20 June 2023, 09:00-10:45
Chairs: Amir Babaki, Anandarup Das

PAPERS
09:00-09:20
ISIE23-000036 A DC-DC Modular Multilevel Converter Topology with Single Arm for MVDC Railway Application
Sukrashis Sarkar, Anandarup Das

09:20-09:40
ISIE23-000049 Reverse engineering of the hydrogen system of a commercial fuel cell vehicle
Markus Meindl, Martin März, Johannes Gelling, Richard Öchsner

09:40-10:00
ISIE23-000063 Model Predictive Torque Control of Synchronous Machines Without a Current or Stator Flux Reference Generator
Kyunghwan Choi, Ki-Bum Park

10:00-10:20
ISIE23-000136 Dynamic Wireless Charging Using LCC-S compensation topology in Low and Medium Power Applications
Martin Zavrel, Vladimir Kindl, Miroslav Tyrpek

10:20-10:40
ISIE23-000145 Optimal Components Sizing and Power Management for a Fuel Cell Electric Race Car Using a Bi-level Strategy
Essolizam PLANTE, Mylène Delhommais, Eric Bideaux, Mathias Gerard

M1 TT 03-3 Power Systems and the Smart Grid, Renewable Energy Systems and Smart Grid
Tuesday, 20 June 2023, 09:00-10:45
Chairs: Ties van der Heijden, Ali Mehrizi-Sani

PAPERS
09:00-09:20
ISIE23-000105 Closed-loop simulation testing of a probabilistic DR framework for Day Ahead Market participation applied to Battery Energy Storage Systems
Ties van der Heijden, Edo Abraham, Peter Palensky, Nick van de Giesen

09:20-09:40
ISIE23-000149 High-performance IoT Module for controlling and testing PV panels
Miguel Tradacete Ágreda, Enrique Santiso Gómez, Francisco Javier Rodríguez Sánchez, Pablo José Hueros Barrios, Carlos Santos Pérez, Rafael Pérez Sergui

09:40-10:00
ISIE23-000155 Multifrequency Power Transfer in a Power Distribution Line
Xavier Genaro-Muñoz, Hugo Valderrama-Blavi, Roberto Giral

10:00-10:20
ISIE23-000210 Harmonic Interaction of Voltage Source Converters in Grid Parallel Operation
Duc-Thanh Do

Y228a WIP SS 02-3 Machine Vision
Tuesday, 20 June 2023, 09:00-10:45
Chairs: Danilo Caceres Hernández, Huei-Yung Lin

PAPERS
09:00-09:20
ISIE23-000096 Improving Vehicle Localisation with Lane Marking Detection Based on Visual Perception and Geographic Information
Huei-Yung Lin, Jun-Yi Lee
09:20-09:40
ISIE23-000224 Walking Optimization for Humanoid Robots Combining Screw Algebra with Genetic Algorithm
Paulo Fernando Ferreira Rosa, Fabio Suim Chagas, Luis David Peregrino de Farias, Franciele Sembay, José Lauro O. Schramm, Gabriel M. Lima, Ana L. Buze, Mateus S. Carvalho

09:40-10:00
ISIE23-000272 Real-time Dynamic Obstacle Avoidance For A Non-holonomic Mobile Robot
Mukhtar Sani, Ahmad Hably, Bogdan Robu, Jonathan Dumon, Nacim Meslem

10:00-10:20
ISIE23-000132 Method of Artificial Vision in Guide Cane for Visually Impaired People.
Leonardo Medina, Julio Rodriguez, Oscar Real-Moreno, Dayanna Ortiz, Wendy Flores-Fuentes, Oleg Serglyenko, Moises J. Castro-Toscano, Paolo Mercorelli

10:20-10:40
ISIE23-000261 Asynchronous Multi-Task Learning Based on One Stage YOLOR Algorithm
Cheng-Fu Liou

C Hall TT 05-5 Power Electronics
Tuesday, 20 June 2023, 09:00-10:45
Chairs: Antonio J. Marques Cardoso, Rayane Mourouvin

PAPERS

09:00-09:20
ISIE23-000108 I/O-Linearization Based Current Decoupling Control of Modular Multilevel Cascade Converters
Oliver Kaimbach, Christoph M. Hackl

09:20-09:40
ISIE23-000119 Thermo-Electrical Modeling of Multilevel Switching-Cell-Array-Based Power Converters
Roya Rafiezadeh, Sergio Busquets-Monge, Salvador Alepuz

09:40-10:00
ISIE23-000120 Variant Parameters Identification of the PEMEL Circuit Model by RMSE-Based Self-Tuning Method
Hamed Nezhadkhatami, Amin Hajizadeh, Mohsen Soltani, Damien Guilbert

10:00-10:20
ISIE23-000125 Improved Dead-Beat Control for Single-Phase LC-Coupling Hybrid Active Power Filter (LC-HAPF)
Pak-Ian Chan, Wai-Kit Sou, Chi-Seng Lam

10:20-10:40
ISIE23-000120 Variant Parameters Identification of the PEMEL Circuit Model by RMSE-Based Self-Tuning Method
Hamed Nezhadkhatami, Amin Hajizadeh, Mohsen Soltani, Damien Guilbert

Y229c TT 06-1
Tuesday, 20 June 2023, 09:00-10:45
Chairs: Romain Delpoux

PAPERS

09:00-09:20
ISIE23-000055 Adaptive Low-Computation Neural Network Control of Constrained Nonlinear Systems and Its Application to Agricultural Drones
Kang Liu, Po Yang, Rujing Wang

09:20-09:40
ISIE23-000060 Model Predictive Control Method for Nonisolated Universal Battery Charger
Naki Guler, Ugur Fesli, Hasan Komurcugil, Sertac Bayhan

09:40-10:00
ISIE23-000116 Distributed Sensor Fault Detection for Sensor Networks
Jiarui Zhang, Steven X. Ding, Linlin Li

10:00-10:20
ISIE23-000205 Online Exciter Controller Tuning for a Synchronous Condenser in a Weak Grid
Ehsan Fouladi, Fatemeh Sharifi, Ali Mehrizi-Sani

10:20-10:40
ISIE23-000227 Finite element dq-model for MTPA flux control of Synchronous Reluctance Motor (SynRM)
Romain DELPOUX, Thomas Huguet, Federico Bribiesca Argomedo, Loïc Queval, Jean-Yves Gauthier, Zohra Kader
### Y228b SS 14-1

**Tuesday, 20 June 2023, 09:00-10:45**  
**Chairs:** Makoto Iwasaki, Daisuke Chugo

#### PAPERS

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<tbody>
<tr>
<td>09:00-09:20</td>
<td>ISIE23-000144 Finger Force Distribution Measurement System with Inclination Correction Function</td>
<td>Lu Zhao, Koji Makino, Yasuo Kondo, Kazuki Yamada, Xiao Sun, Hidetsugu Terada</td>
</tr>
<tr>
<td>09:40-10:00</td>
<td>ISIE23-000304 Shoe-type Wearable Device for Measuring Ground Reaction Force and Center of Pressure</td>
<td>Ryuichi Kawasaki, Seiichiro Katsura</td>
</tr>
<tr>
<td>10:00-10:20</td>
<td>ISIE23-000335 Dominant Hand Invariant Parkinson’s Disease Detection Using 1-D CNN Model and STFT-based IMU Data Fusion</td>
<td>Aleksei Shcherbak, Ekaterina Kovalenko, Ekaterina Bril, Anna Baldycheva, Andrey Somov</td>
</tr>
<tr>
<td>10:20-10:40</td>
<td>ISIE23-000354 Analysis of Rehabilitation Methods for Small Dogs Based on the Muscular Activity</td>
<td>Daisuke Chugo, Yujie Li, satoshi muramatsu, Sho Yokota, Jinhua She, Hiroshi Hashimoto, Hiroaki Kamishina, Hiroyuki Hirabayashi</td>
</tr>
</tbody>
</table>

### Y307a TT 02-2 Electric Energy Storage

**Tuesday, 20 June 2023, 09:00-10:45**  
**Chairs:** Annukka Santasalo-Aarnio

#### PAPERS

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<th>Time</th>
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<tbody>
<tr>
<td>09:00-09:20</td>
<td>ISIE23-000017 Parameter Estimation of Second-Life Lithium-Ion Batteries Through Subspace Identification Methods</td>
<td>Marcelo Camboim, Aghatta Moreira, Mateus Giesbrecht</td>
</tr>
<tr>
<td>09:20-09:40</td>
<td>ISIE23-000046 Unscented Kalman Filter based Coestimation of SoC and SoH in Lithium Battery with Hysteresis</td>
<td>Luca Amyn Hattouti, Roberto Di Rienzo, Federico Baronti, Roberto Roncella, ROBERTO SALETTI, Gianluca Aurilio, Riccardo Di Dio, Walter Nesci</td>
</tr>
<tr>
<td>09:40-10:00</td>
<td>ISIE23-000074 Optimized Passive Battery Cell Balancing Algorithm for a Low-Cost Race Car</td>
<td>Matteo Bonora, Roberto Passerone</td>
</tr>
<tr>
<td>10:00-10:20</td>
<td>ISIE23-000079 The in-plane thermal conductivity of lithium-ion cells: Parametric influences and simulative prediction</td>
<td>Luca Tendera</td>
</tr>
<tr>
<td>10:20-10:40</td>
<td>ISIE23-000115 Charging Control of A Vanadium Redox Flow Battery Integrated With Solar PV Plant</td>
<td>Mojtaba Hajihosseini, Mateja Car, Zeeshan Aleem, Vinko Leši</td>
</tr>
</tbody>
</table>

**Coffee break**  
**Tuesday, 20 June 2023, 10:30-11:00**
**Keynote 2: The intelligent automation experience**

**Rikard Franz**  
Head of development department of Processing Automation, Tetra Pak, Sweden

**Abstract:**  
Over the years, automation has improved performance in most production sites in the world and is actually seen as the 3rd revolution in the industry. The addition of the digitalization, has further improved the value of automation. As most people are currently wondering about how to make the best use of this we are thinking of how we can make the journey easier for people working with these solutions.  
How can we make life easier for operators, maintenance people and managers. We have to add a new level to automation solutions, where things like UX and UI, linked to artificial intelligence will even further enhance the operations at production sites. Also, how can we make sure that Cyber Security threats does not put an abrupt end to this journey.

**Speaker Bio:**  
With a long experience in Process Automation and manufacturing, Rikard is now heading the development department of Processing Automation at Tetra Pak, being an expert in plant control, monitoring, and automation services. After finalizing his master’s degree at Lund University, Rikard started to work with Automation as a programmer. Over the years, various positions in Project Management, automation sales and management has taken Rikard to the senior expert position he is having today.

**Keynote 4: The digital twin: The why and the how**

**Alexander Fay**  
Professor and Head of the Institute of Automation Technology, Helmut Schmidt University, Germany

**Abstract:**  
Digital Twins have gained increasing interest during the last years. Various concepts and technologies exist for the implementation of Digital Twins, and their possible applications are multifold. Beyond promising perspectives, companies long for advice where they should start with applying Digital Twins: should they build Digital Twins to support their development processes, or their production? Or rather Digital Twins of their products, for better maintenance and update services? Should they restrict access to these Digital Twins to own staff, or can Digital Twins offer new perspectives also for their customers? Furthermore, Digital Twins will be gamechangers for lifecycle services. New business opportunities arise, and thus, new players. Who will be the owner of the Digital Twin and the data it comprises and generates? Which capabilities are required to make use out of it? How will this change the value chain of engineering and operation of systems in production, logistics, transport and energy distribution? These questions are the subject of this keynote, and methods how to find answers, individually for one's business: How to position in future in the value chain, how to identify attractive applications of the Digital Twin, how to identify which information is required to set up a Digital Twin, and how to make best use of standards and existing information.

**Speaker Bio:**  
Alexander Fay (IEEE Member ’02, Senior Member ’07) is Full Professor and Head of the Institute of Automation Technology at the Helmut-Schmidt-University in Hamburg, Germany. His main research interests are models and methods for the engineering of large automated systems, especially in the process and manufacturing industries, in buildings and transportation systems. With his research team, he develops and employs knowledge-based methods,
ontologies, autonomous systems and other AI techniques. The aim of his team is to develop models, methods and tools to increase engineering efficiency and to assist in the engineering and operation of industrial plants. He is member of the Scientific Board of the German Society for Measurement and Automation (GMA) and Head of its Department "Methods of Automation". He was a member of the IEEE Industrial Electronics Society Administration Committee between 2009 and 2011. Between 2009 and 2017, he served as an Associate Editor of IEEE Transactions on Industrial Informatics. Alexander Fay is a member of acatech, the German Academy of Engineering Sciences. Since 2014, he has been a member of the Scientific Advisory Board and of the WG 2 "Research and Innovation" of the German "Industrie 4.0" initiative.

14:30-15:30

**Y405 TT 04-4 Electrical Machines and Drives**

**Tuesday, 20 June 2023, 14:30-15:30**

**Chairs:** José Daviu, Yannick Karekezi

**PAPERS**

14:30-14:50

ISIE23-000162 Quadratic Regression Model based Predictive Control of PMSM Drives with field weakening operation capability constrained to linear modulation range

Kristóf Bándy, Péter Stumpf

14:50-15:10

ISIE23-000163 A PMaSynRM stator winding fault detection approach using an optimized PCA-based EWMA control scheme

Pakedam LARE, Siyamak SARABI, Claude DELPHA, Demba DIALLO

15:10-15:30

ISIE23-000170 Dynamic Drive Cycle Model of a Fuel-Cell Powered Hybrid Bus

Martin Novak, Jan Gruber

14:30-15:30

**Y229 aTT 01-2 & WIP TT 01**

**New Technologies for Electric Transportation**

**Tuesday, 20 June 2023, 14:30-15:30**

**Chairs:** Amir Babaki, Anandarup Das

**PAPERS**

14:30-14:50

ISIE23-000285 Feasibility Study of Using Modified Single-Phase Wireless Power Transfer System for Three-Phases Motor Driving

Alireza Jafari-Natanzi, Amir Babaki, Thomas Ebel, Sadegh Vaez-Zadeh

14:50-15:10

ISIE23-000381 Tangentially-Magnetized-Slot-PM-Assisted Magnet Saturation Relieving Design for Doubly Salient Reluctance Machine Position Sensorless Drive Applications

Weiyu Wang, Shuangxia Niu, Xing Zhao, Weinong Fu

15:10-15:30

ISIE23-000364 Staggered Ackermann Steering Geometry for Autonomous Driving of a Paired E-Scooter System

Michael Frye, William Qian

14:30-15:30

**E Hall TC Meeting - Power Electronics**

**Tuesday, 20 June 2023, 14:30-15:30**

**M1 TT 03-4 Power Systems and the Smart Grid, Renewable Energy Systems and Smart Grid**

**Tuesday, 20 June 2023, 14:30-15:30**

**Chairs:** Jin Won Hwang, Chen-Wei Yang

**PAPERS**

14:30-14:50

ISIE23-000225 Phase-independent control of a three-phase four-leg inverter

Iñaki Aizpuru, Asier Davila, Estefanía Planas, José Luis Martín, José Antonio Cortajarena

14:50-15:10

ISIE23-000265 Exploration of For-Purpose Decentralized Algorithmic Cyber Attacks in EV Charging Control

Mahan Fakouri Fard, Xiang Huo, Mingxi Liu
Y228a TC Meeting - Standards  
Tuesday, 20 June 2023, 14:30-15:30

Y347 TC Meeting - Control, Robotics, and Mechatronics  
Tuesday, 20 June 2023, 14:30-15:30

C Hall TT 05-6 Power Electronics & Energy Conversion  
Tuesday, 20 June 2023, 14:30-15:30  
Chairs: Rayane Mourouvin

PAPERS

14:30-14:50  
ISIE23-000173 Input Impedance Modeling of Dual-Active-Bridge-Based Input-Series Output-Parallel Converters  
Jiajun Yang, Sandro Guenter, Giampaolo Buticchi, Chunyang Gu, Marco Liserre, Pat Wheeler

14:50-15:10  
ISIE23-000177 Basic Study of a Heat Distribution Control Method for an Induction Heating System with Three AC-AC Direct Converters  
Shunta Inami, Shohei Komeda

15:10-15:30  
ISIE23-000181 A Detection Method of Misalignment for a WPT System using Three-Power Transfer Circuits  
Rin Arai, Shohei Komeda

M240 TT 12-2 WIP  
Tuesday, 20 June 2023, 14:30-15:30  
Chairs: Kim Fung Tsang

PAPERS

14:30-14:50  
ISIE23-000363 FIWARE-based Architecture for Smart Local Energy Communities  
Max Thoma, Gernot Steindl, Wolfgang Kastner

14:50-15:10  
ISIE23-000373 Black Soldier Fly Bioconversion System: A Digital Twin Approach  
Cheng Pang

15:10-15:30  
ISIE23-000374 Detection of Powdery Mildew Pest in Apple Tree Leaves Using Deep Learning in Intelligent Sprayer Robots  
Majid Sorouri, Ali Aghajanpoor, Arash Sharifi

Y229c TT 06-2 Control Systems  
Tuesday, 20 June 2023, 14:30-15:30  
Chairs: Romain Delpoux, Jiarui Zhang

PAPERS

14:30-14:50  
ISIE23-000257 Flatness-Based Control for Transient Current Suppression in a Dual Active Bridge Converter  
Simon Ulicich, Bruno ALLARD, Xuefang Lin Shi, Jean-Yves Gauthier

14:50-15:10  
ISIE23-000283 Analysis of the zero dynamics of three-phase current source inverters using a complex-valued approach  
Leila Rahimi, Arnau Doria-Cerezo, Robert Grino

Y228b SS 10-1  
Tuesday, 20 June 2023, 14:30-15:30  
Chairs: Tomoyuki Shimono, Tomoya Kitamura

PAPERS

14:30-14:50  
ISIE23-000194 Verification of Anode Position and Generated Force Vector of EHD at Wire-cylinder Electrode  
Tomoya Kitamura, Hiroaki Katagiri, Shigeki Yashita, Yuki Saito, Hiroshi Asai, Kouhei Ohnishi, Takahiro Nozaki

14:50-15:10  
ISIE23-000195 Development of Optical Proximity/Biaxial Force Sensor and Application to Contact Movement  
Tomoaki Baba, Toshiyuki Murakami, Hermano Igo Krebs, Takahiro Nozaki

15:10-15:30  
ISIE23-000208 Handheld Haptic Drill Simulator Using Visual Servoing System for Axial Force Presentation  
Takuya Matsunaga, Shunya Takano, Tomoyuki Shimono, Kouhei Ohnishi, Mitsuru Yagi, Masaya Nakamura
Tuesday, 20 June 2023, 14:30-15:30
Chairs: Kanghyun Jo, Marta Marrón

PAPERS
14:30-14:50
ISIE23-000385 Accurate RF-sensing of complex gestures using RFID with variable phase-profiles
Sahar Golipoor, Stephan Sigg

14:50-15:10
ISIE23-000386 Work-in-Progress: Multi-modal Odour and Image Recognition on Synthetic Dataset
Fanny Monori, Alin Tisan

Tuesday, 20 June 2023, 14:30-15:30
Chairs: Polina Ovsiannikova, Christoph Binder

PAPERS
14:30-14:50
ISIE23-000152 From Model to Implementation: Engineering of flexible Production Systems with RAMI 4.0
Christoph Binder, Ambra Calà, Jan Vollmar, Christian Neureiter, Arndt Leder

14:50-15:10
ISIE23-000196 Onsite Renewable Generation Time Shifting for Photovoltaic Systems
Rakshith Subramanya, Harri Aaltonen, Seppo Sieria, Valeriy Vyatkin

15:10-15:30
ISIE23-000282 Method for Automatic Simulation Model Calibration and Maintenance for Brownfield Process Plants
Malte Ramonat, Alexander Fay

Coffee break
Tuesday, 20 June 2023, 15:30-16:00

Tuesday, 20 June 2023, 16:00-17:30
Chairs: Maria Carmela Di Piazza, Kostas Siozios

PAPERS
16:00-16:20
ISIE23-000216 ANN-based forecasting of solar irradiation under data clustering: an approach for improved estimation of PV power production
Giuseppe La Tona, Maria Di Piazza

16:20-16:40
ISIE23-000220 ICE: A Low-Cost IoT Platform Targeting Real-Time Anonymous Visitors Flow Tracking at Museums
Vasileios Serasidis, Ioannis Sofianidis, George Margaritis, Christos Sad, Vasileios Konstantakos, Kostas Siozios

16:40-17:00
ISIE23-000244 Embedded Intelligence of End Devices with MOS Sensors for CH4 Detection
Simão Leite, Rui Costa, João Carvalho, Tomás Sapage, Rui Bessa, Sofia Paiva

17:00-17:20
ISIE23-000297 Evaluation of AIoT-based Smart Lighting System: An IDex Case Study
Hao Wang, Kim Fung Tsang, Yang WEI

Tuesday, 20 June 2023, 16:00-17:45
Chairs: Kanghyun Jo, Jie Liu

PAPERS
16:00-16:20
ISIE23-000352 Classifying Breast Cancer Histopathological Images Using Attention Guided Convolutional Neural Network
Musfequa Rahman, ANIK SEN, Kaushik Deb, Kanghyun Jo

16:20-16:40
ISIE23-000061 Attack prevention and detection for cyber-physical systems based on coprime factorization technique
Shimeng Wu, Hao Luo, Yuchen Jiang, Kuan Li
16:40-17:00
ISIE23-000088 An Interoperability Middleware for IIoT Gateways
Pedro Henrique Morgan Pereira, Edison Pignaton De Freitas, Carlos E. Pereira, Gustavo Cainelli, João Paulo J. da Costa

17:00-17:20
ISIE23-000154 Sustainability of ICPS from a Safety Perspective: Challenges and Opportunities
Muhammad Gibran Alfarizi, JIE LIU, Jørn Vatn, Shen Yin

17:20-17:40
ISIE23-000279 Cybersecurity of Industrial Automation and Control System (IACS) Networks in Biomass Power Plants
Montri Wiboonrat

16:00-18:00

Y405 TT 04-5 Electrical Machines and Drives
Tuesday, 20 June 2023, 16:00-18:00
Chairs: José Daviu, Yannick Kerekezi

PAPERS
16:00-16:20
ISIE23-000171 Modeling and Experimental Validation of a LTO Battery Cell for a Hydrogen Hybrid Bus
Martin Novak, Zdenek Novák

16:20-16:40
ISIE23-000180 Comparative Study of Excitation Signals for Active Fault Diagnosis of Belt Drives
Moritz Fehsenfeld, Johannes Kühn, Karl-Philipp Kortmann

16:40-17:00
ISIE23-000198 Influence of the Flux Sensor Position for Rotor Fault Detection in WRIM: A Power Spectral Entropy Analysis
Jose Guerra Carmenate, Miguel Iglesias Martínez, Jose Antonino Daviu, Pedro Fernandez de Cordoba, Dunai Larisa, Alfredo Quijano-Lopez

17:00-17:20
ISIE23-000270 Design and Performance Optimization of a Novel High Temperature Superconducting Linear Flux-Switching Motor
Xiangdong SU, Hang ZHAO, Fang LI

17:20-17:40
ISIE23-000280 Automatic classification of stator asymmetries and insulation thermal damages in induction motors, applying persistence spectrum and a convolutional neural network to the stray-flux signals
Vicente Biot-Monterde, Angela Navarro, Israel Zamudio-Ramirez, Jose Antonio Daviú, Roque Osorno-Rios, Jose E. Ruiz-Sarrio

17:40-18:00
ISIE23-000287 Automatic classification of stator asymmetries and insulation thermal damages in induction motors, applying persistence spectrum and a convolutional neural network to the stray-flux signals
Vicente Biot-Monterde, Angela Navarro, Israel Zamudio-Ramirez, Jose Antonio Daviú, Roque Osorno-Rios, Jose E. Ruiz-Sarrio

Y307 TT 07-4 Motion Control, Robotics and Mechatronics
Tuesday, 20 June 2023, 16:00-18:00
Chairs: Polina Ovsiannikova

PAPERS
16:00-16:20
ISIE23-000010 API for data transfer using USB to CAN converter
Robert Plšíčík, Matúš Danko

16:20-16:40
ISIE23-000053 Decentralized Motion Control for a Novel Planar Motor Intralogistics System
Lukas Steinle, Nico Helfesrieder, Armin Lechner, Alexander Verl, Ali Montazeri, Jinfan Wang

16:40-17:00
ISIE23-000058 Learning Diverse and Efficient Goal-reaching Policies for Robot Motion Planning
Han-Cheng Yao, Chi-Kai Ho, Chung-Ta King

17:00-17:20
ISIE23-000159 Extending Edge-Based Mobile Robot Navigation with Social Awareness
Gábor Fehér, Dániel Rózsa, Marcell Balogh, Norbert Reider

B Hall IEEE IES Publications Committee Meeting
Tuesday, 20 June 2023, 13:30-16:00
**M1 TT 03-5 Power Systems and the Smart Grid, Renewable Energy Systems and Smart Grid**

**Tuesday, 20 June 2023, 16:00-18:00**

**Chairs:** Jin Won Hwang, Chen-Wei Yang

**PAPERS**

16:00-16:20  
ISIE23-000289 On interoperability of Data-centre and the Energy market in the Nordic Region  
Chen-Wei Yang, Nikolai Galkin, Valeriy Vyatkin

16:20-16:40  
ISIE23-000292 An emulator for static and dynamic performance evaluation of small wind turbines  
Adrien Prévost, Vincent Léchappé, Romain DELPOUX, Xavier Brun

16:40-17:00  
ISIE23-000312 Mapping the Optimal Sites for Offshore Wind Power Plants and Green Hydrogen Production: South and Southeast Brazilian Case Study  
Karen Paula, Hayro Pumaloclla, Mahdi Pourakbari Kasmaei, Joel Melo, Djalma Falcao

17:00-17:20  
ISIE23-000313 A low-cost digital twin for real-time monitoring of photovoltaic panels  
Pablo José Hueros-Barrios, Francisco Javier Rodríguez Sánchez, Miguel Tradacete Ágreda, Pedro Martín, Carlos Santos, David Pérez Saura

17:20-17:40  
ISIE23-000323 Photovoltaic and Wind Power Plants Production Profiles Generation from Scarce Data  
Antonio Karneluti, Filip Rukavina, Mario Vašak

17:40-18:00  
ISIE23-000325 Fast Earth-Fault and Feeder Detection in Medium-Voltage Distribution Power Grids  
Tomáš Komrška, Josef Štengl, Zden k Peroutka

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**C Hall TT 05-7**

**Tuesday, 20 June 2023, 16:00-18:00**

**Chairs:** Alvaro Iribarren, Rayane Mourouvin

**PAPERS**

16:00-16:20  
ISIE23-000281 Voltage Balancing Analysis of DC-Link Capacitors in Six-phase Three-Level T-Type Inverters  
Luca Vancini, Michele Mengoni, Gabriele Rizzoli, Luca Zarri, Angelo Tani

16:20-16:40  
ISIE23-000338 Choke-less Class-E Oscillator Using p-MOSFET and n-MOSFET  
Yuta Ikutajima, Hirotaka Koizumi

16:40-17:00  
ISIE23-000346 A Novel Technique to Mitigate the Overlap-Time Effect in Current Source Inverters  
Umer Sohail, Trond Østrem, Bjarte Hoff

17:00-17:20  
ISIE23-000253 Small-Signal Stability Analysis of Power Converters with Optimal Pulsewidth Modulation Strategies  
Leyre Rosado, Javier Samanes, Jesus Lopez, Eugenio Gubia

17:20-17:40  
ISIE23-000039 Wireless Power Transfer with Resonant Pulsed Current Converter  
Dodi Garinto, Theodora Valerie

17:40-18:00  
ISIE23-000082 Enhancement of Steady State Response of Indirect Finite Control Set Model Predictive Control  
Saad Hamayoon, Morten Hovd, Jon Are Suul
M240 SS 13-2 & WIP
Tuesday, 20 June 2023, 16:00-18:00
Chairs: Zaixin Song, Chunhua Liu

PAPERS
16:00-16:20
ISIE23-000218 Optimization design of permanent magnet synchronous motor torque ripple based on stator tooth crown slotting method
Mingle Jin, Ling Luo, Yuan Chai, jian song, Fei Jiang, Yixin Shao

16:20-16:40
ISIE23-000234 FPGA Validated Advanced Learning-based Voltage Control of DC/DC converter feeding CPL in DC Microgrid applications
Hussain Khan, Kimmo Kauhaniemi

16:40-17:00
ISIE23-000250 Design Considerations of Outer-Rotor Flux-Modulated Permanent-Magnet In-Wheel Motors
Zekang Huang, Yixiao Luo, Wenyuan Mi, Zheng Cai, Fei Zhao, Hang Zhao, Jincheng Yu

17:00-17:20
ISIE23-000266 A Fast Low-Cost Neuron Network Controller with Ripple Suppression Based on Model Predictive Direct Speed Control with Continuous Control Set and Long Horizon
Yuxuan Liu, Shuangxia Niu

17:20-17:40
ISIE23-000288 Overshoot Reduction Inspired Recurrent RBF Neural Network Controller Design for PMSM
Zhenxiao Yin, Hang ZHAO

17:40-18:00
ISIE23-000142 Design of A Novel Double-Stator Fault-Tolerant Transverse Flux Permanent Magnet Machine for Electric Propulsion Aircraft
Bowen Zhang, Rundong Huang, Zaixin Song, Wusen Wang, Zhiping Dong, Chunhua Liu

Y228b SS 10-2
Tuesday, 20 June 2023, 16:00-18:00
Chairs: Tomoyuki Shimono, Tomoya Kitamura

PAPERS
16:00-16:20
ISIE23-000211 Model-Based Pitch Angle Compensation for Center of Gravity Variation in Underactuated System with an Arm
Hirotaka Kanazawa, Kosuke Ishizaki, Yasuhiro Miyata, Masamichi Nawa, Norihiko Kato, Toshiyuki Murakami

16:20-16:40
ISIE23-000213 Frequency-Domain Modeling-Free Iterative Learning Control for Point-To-Point Motion
Yoshihiro Maeda, Makoto Iwasaki

16:40-17:00
ISIE23-000286 Universal Motion Controller: Adaptive Approach
Tarik Uzunovic, Sabanovic Asif

17:00-17:20
ISIE23-000300 Underactuated Control for Two-Wheeled Mobile Robot with an Arm Using Torque Constraint Conditions and Disturbance Observer
Jin Ito, Toshiyuki Murakami

Y313 TT 09-3 Signal and Image Processing and Computational Intelligence
Tuesday, 20 June 2023, 16:00-18:00
Chairs: Alin Tisan, Óscar Lucía

PAPERS
16:00-16:20
ISIE23-000305 Rapid FPGA implementation of a cost effective quaternion LMS estimator
Alin Tisan, Clive Cheong Took

16:20-16:40
ISIE23-000350 DenseNetx: Efficient DenseNets for Remote Scene Classification without Pretraining
Russo Ashraf, Tien-Dat Tran, Ge Cao, Kanghyun Jo
16:40-17:00
ISIE23-000353 Classification of Lung and Colon Cancer Histopathological Images Using Attention Based Convolutional Neural Network
Md. Al-Mamun Provath, Syed Md. Minhaz Hossain, Kaushik Deb, Kanghyun Jo

17:00-17:20
ISIE23-000189 Vibration Auralization System Using High-Speed Vision
Kotaro Fujita, Feiyue Wang, Kohei Shimasaki, Idaku Ishii, Ryo Okamoto, Hironori Higashida

17:20-17:40
ISIE23-000190 A Comparison of Extended Kalman Filters for Parameter Estimation of Sinusoidal Signals
Luis A. Barragan, Hector Sarnago, Denis Navarro, Oscar Luca

17:40-18:00
ISIE23-000207 Unifying Local and Global Fourier Features for Image Classification
Xuan-Thuy Vo, Jehwan Choi, Duy-Linh Nguyen, Adri Priadana, Kanghyun Jo

Y307a TT 10-4 Industrial Informatics: Cloud Computing, Big Data, AI, Informatics and Software Engineering
Tuesday, 20 June 2023, 16:00-18:00
Chairs: Kanghyun Jo, Nishan Mills

PAPERS
16:00-16:20
ISIE23-000291 Driving Profile Analysis Using Machine Learning Techniques and ECU Data
Rafael Canal, Giovani Gracioli, Felipe Kaminsky Riffel

16:20-16:40
ISIE23-000314 Formal verification of observers supervising a cyber-physical system implemented using IEC 61499
Polina Ovsianiikova, Etienne Le Priol, Vincent Perret, Pranay Jhunjhunwala, Midhun Xavier, Valeriy Vyatkin

16:40-17:00
ISIE23-000318 Methods of data streaming from IEC 61499 applications to Cloud storages
Tatiana Liakh, Tuojian Lyu, Nikolai Galkin, Chen-Wei Yang, Valeriy Vyatkin

17:00-17:20
ISIE23-000321 Efficient Multi-Receptive Pooling YOLOv5 with Coordinate Attention Module for Object Detection on Drone
Jinsu An, Muhamad Dwisnanto Putro, Priadana Adri, Youlkyeong Lee, Junmyeong Kim, Kanghyun Jo

17:20-17:40
ISIE23-000322 A Cybersecurity Framework for Home Energy Management Systems using Artificial Intelligence
Lakshitha Gunasekara, Harsha Moraliyage, Daswin de Silva, Nishan Mills, Damminda Alahakoon, Andrew Jennings, Milos Manic

17:40-18:00
ISIE23-000324 Concept of blockchain based micro-service control strategy for a domestic water heater
Primož Podržaj

Y346 WIP SS 14-2
Tuesday, 20 June 2023, 16:00-18:00
Chairs: Daisuke Chugo, Makoto Iwasaki

PAPERS
16:00-16:20
ISIE23-000365 Feasibility of Smartphone-Attached UWB Tag for Daily life Indoor Pedestrian Tracking
Khawar Naheem, Mun Sang Kim

16:20-16:40
ISIE23-000378 Disturbance rejection for pedaling rehabilitation robot based on integration of equivalent-disturbance-rejection and repetitive control methods
Yujian Zhou, Jinhua She, Feng Wang, Makoto Iwasaki

16:40-17:00
ISIE23-000396 Cognitive assistance for the visually impaired using haptics presentation of environmental information
Takumi Sato, Mihoko Niitsuma

Gala Dinner
Tuesday, 20 June 2023, 19:00-21:00
Gala Dinner at Pikku Finlandia / Little Finlandia Hall : Mannerheimintie 13 E, 00100 Helsinki
Y229a TT 08-1 Instrumentation, Sensors, Actuators, Systems Integration and Nano-Technology

Wednesday, 21 June 2023, 09:00-10:30
Chairs: Frank Wasinski, Kazi Jaleb Akram

PAPERS

09:00-09:20
ISIE23-000080 Concept of an Optical Distance and Speed Sensor Using Novel Offsetless Spatial Frequency Filters in the Area of Functional Safety
Frank Wasinski, Werner Bonath

09:20-09:40
ISIE23-000138 Experimental Qualification of a Low-Noise Charge-Sensitive ROIC with Very High Time Resolution
Alireza Mohammad Zaki, Stoyan Nhtianov

09:40-10:00
ISIE23-000228 Capacitive Sensor-based Smart Water Tap: A Feasibility Study
Kazi Jaleb Akram, Saikumar V, Boby George

10:00-10:20
ISIE23-000034 Physics-data cooperative ship motion prediction with onboard wave radar for safe operations
Motoyasu Kanazawa, Tongtong Wang, Robert Skulstad, Guoyuan Li, Houxiang Zhang

Y228a TT 03-6 & WIP Power Systems and the Smart Grid

Wednesday, 21 June 2023, 09:00-10:30
Chairs: Jin Kwon Hwang, Maximilien Marc

PAPERS

09:00-09:20
ISIE23-000277 Frequency-Domain System Identification of a First Order Governor-Turbine Model from PMU Ambient Data
JINK WON HWANG, Janne Seppänen

09:20-09:40
ISIE23-000369 On the Relationship between Inter-Area Modes and Power System Inertia
Janne Seppänen, JINK WON HWANG, Matti Lehtonen

09:40-10:00
ISIE23-000382 LVDC vs LVAC: A comparison of system losses
Maximilien MARC, Dominique Roggo, Mlikka Säteri, Tero Tuomarmäki, Samuli Ranta

10:00-10:20
Liang GUO, Zhongliang LI, Rachid OUTBIB

M240 TT 10-5 Industrial Informatics: Cloud Computing, Big Data, AI, Informatics and Software Engineering

Wednesday, 21 June 2023, 09:00-10:30
Chairs: Nishan Mills, Harsha Moraliyage

PAPERS

09:00-09:20
Harsha Moraliyage, Diantha Haputhanthri, Chamod Samarajeewa, Nishan Mills, Daswin de Silva, Milos Manic, Andrew Jennings

09:20-09:40
ISIE23-000327 Tiny Federated Learning with Bayesian Classifiers
Ning Xiong, Sasikumar Punnekkat

09:40-10:00
ISIE23-000330 Debugging approach for IEC 61499 control applications in FBME\ Tatiana Liakh, Radimir Sorokin, Danil Akifev, Polina Ovsiannikova, Valeriy Vyatkin

10:00-10:20
ISIE23-000336 Augmenting Industrial Chatbots in Energy Systems using ChatGPT Generative AI
Gihan Sameera Wirithhamulla Gamage, sachin kahawala, Nishan Mills, Daswin de Silva, Milos Manic, Damminda Alahakoon, Andrew Jennings
**C Hall TT 05-8 Power Electronics & Energy Conversion**

Wednesday, 21 June 2023, 09:00-10:45  
**Chairs:** Rayane Mourouvin, Hirotaka Koizumi

**PAPERS**

09:00-09:20  
ISIE23-000209 Fault-Tolerant Active Neutral-Point-Clamped Multilevel Inverter Maintaining Output Voltage at Failure  
Jun Hitokuwata, Hirotaka Koizumi

09:20-09:40  
ISIE23-000214 Selective harmonic mitigation-pulse amplitude modulation technique for 7-level inverters  
Concettina Buccella, Maria Gabriella Cimoroni, Francesco Simonetti, Carlo Cecati

09:40-10:00  
ISIE23-000217 SiC JFET/P-MOSFET cascode for SSCB and inrush current limiter in 300V DC power systems  
Ausias Garrigos, David Marroqui, José Manuel Blanes, Cristian Torres, Carlos Orts, Pablo Casado

10:00-10:20  
ISIE23-000245 MODELLING AND CONTROL OF MULTI-PORT DC-DC CONVERTER FOR OFFSHORE WIND-HYDROGEN ENERGY SYSTEMS  
Shahriar Farajdadian, Amin Hajizadeh, Mohsen Soltani

10:20-10:40  
ISIE23-000273 Multi-Objective SHM-PWM Modulation Technique for CMV Control in 3-Phase Inverters  
Mohammad Sharifzadeh, Mahdieh Sadabadi, Eric Laurendeau, Kamal Al-Haddad

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**Y228b SS 05-1**

Wednesday, 21 June 2023, 09:00-10:45  
**Chairs:** Dirk Benyoucef, Djaffar Ould Abdeslam

**PAPERS**

09:00-09:20  
ISIE23-000093 A New Optimal Centralized Demand Side Management for a Campus Smart Microgrid  
Mohamed Hassan

09:40-10:00  
ISIE23-000161 LSTM Networks for Cyber-physical Attack Diagnoses in Microgrids  
Bushra CANAAN, Bruno Colicchio, Djaffar OULD ABDESLAM, Lhassane Idoumghar

10:00-10:20  
ISIE23-000238 Model-Free HVAC Optimizer based on Reinforcement Learning  
Charalampos Marantos, Christos Lamprakos, Kostas Siozios, Dimitrios Soudris

10:20-10:40  
ISIE23-000264 Local Energy Marketplace Agents-based Analysis  
Ameni Boumaiza

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**B Hall IEEE IES strategy workshop**

Wednesday, 21 June 2023, 09:00-12:00

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**Coffee break**

Wednesday, 21 June 2023, 10:30-11:00
**SESSIONS**

**Y229a SS 08-1**
Wednesday, 21 June 2023, 11:00-12:00
Chairs: Hadi Kanaan, Romain Delpoux

**PAPERS**

11:00-11:20
ISIE23-000050 Analytical Model and Control Strategy for Three-Phase Single-Stage Rectifier for Battery Charging Applications
Elie PEREZ, Xuefang Lin-Shi, Bruno ALLARD

11:20-11:40
ISIE23-000126 Review of Different Current Control Strategies for Thyristor-Controlled LC-Coupling Hybrid Active Power Filter
Wai-Kit Sou, Pak-Ilan Chan, Cheng Gong, Chi-Seng Lam

11:40-12:00
ISIE23-000197 Attenuation of Voltage Distortion Effects on a Three-Phase Grid-Connected Converter
Alfonso Damiano, Mauro Boi, Andrea Floris, Alessandro Serpi

**C Hall TT 05-9 Power Electronics & Energy Conversion**
Wednesday, 21 June 2023, 11:00-12:00
Chairs: Rayane Mourouvin, Hirotaka Koizumi

**PAPERS**

11:00-11:20
ISIE23-000260 Asymmetrical firing angle modulation for 12-pulse thyristor rectifiers supplying high-power electrolyzers
Alvaro Iribarren Zabalegui, Ernesto L. Barrios, David Elizondo, Pablo Sanchis, Alfredo Ursúa

11:20-11:40
ISIE23-000267 Modeling a Grid-Forming DFIG Wind Turbine
Iker Oraa, Javier Samanés, Jesus Lopez, Eugenio Gubia

11:40-12:00
ISIE23-000268 Switching control to enhance performance in smart protections
Manuela la Rosa, Davide Patti, Giovanni Sicurella, Donata Nicolosi, Salvatore D’Angelo

**M240 TT 10-6 Industrial Informatics: Cloud Computing, Big Data, AI, Informatics and Software Engineering**
Wednesday, 21 June 2023, 11:00-12:00
Chairs: Sandun Mavikumbure, Harsha Moraliyage

**PAPERS**

11:00-11:20
ISIE23-000341 Application of Deep Learning Method to Estimate Bottomhole Pressure Dynamics of Oil Wells
Cheng Haibo

11:20-11:40
ISIE23-000344 Towards migration from IEC 61131-3 to IEC 61499 in process industry: redesign of visualisation
Hiruni Kothalawala, Pranay Jhunjhunwala, Valeriy Vyatkin

11:40-12:00
ISIE23-000349 Physical Anomaly Detection in EV Charging Stations: Physics-based vs ResNet AE
Harindra Sandun Mavikumbure, Victor Cobilean, Chathurika S. Wickramasinghe, Tyler Phillips, Benny J. Varghese, Barney Carlson, Craig Rieger, Timothy Pennington, Milos Manic

**Y228b TT 04-6 & WIP**
Wednesday, 21 June 2023, 11:00-12:00
Chairs: Nader Safari-Shad, Marko Hinkanen

**PAPERS**

11:00-11:20
ISIE23-000395 Online Parameter Estimation of Dual Three-Phase Permanent-Magnet Synchronous Machine for More-Electric Aircraft Applications
Shengyu Cao, Tao Yang, Yuzheng Chen, Serhiy Bozko, Pericle Zanchetta

11:20-11:40
ISIE23-000158 An Investigation into Permanent Magnet Hysteresis Losses in Reverse-salient Permanent Magnet Synchronous Motors
Immanuel Williams, Anouar Belahcen, Shrikrishna Kulkarni
**Keynote 3: Industry 4.0 on Shoestring: The Case for Low-Cost Digitalisation?**

**Duncan McFarlane**
Professor of Industrial Information Engineering / Head of Distributed Information & Automation Lab, University of Cambridge, UK

**Abstract:**
This talk will review the original intent of Industry 4.0 and some of its limitations when being applied in small companies. A systematic template for supporting digitalisation for small manufacturers will be presented and the Digital Manufacturing on a Shoestring programme introduced as a means of addressing key aspects of this template. The key features of the Shoestring programme will be presented along with results of numerous developments and deployments in the last 2-3 years. Future industrial developments and research challenges in this area will be presented.

**Speaker Bio:**
Duncan McFarlane is Professor of Industrial Information Engineering at the University of Cambridge and Head of Distributed Information & Automation Lab and a visiting Professor at University of Melbourne. He began his career as an engineering cadet with BHP in Melbourne and has worked in the industrial automation area for over 25 years joining Cambridge in 1995. He was Research Director of the Auto ID Centre in 2000-3 and subsequently co-founder and Chairman of RedBite Solutions Ltd - an industrial RFID/IoT based asset management solutions company. He is Principal Investigator on the Digital Manufacturing on a Shoestring programme developing low cost digital solutions for small manufacturers with more recent spin-outs into construction, logistics and medical systems. The Shoestring approach is currently being rolled-out with SMEs across several regions in the UK and overseas. From March to July 2020 he led a team which won the RAE Presidents Award for providing Industrial Engineering support to local hospitals managing the Covid-19 Epidemic and from September 2020 to July 2021 was Operations Logistics lead at Cambridge University for its Asymptomatic Covid-19 Student Testing Programme.

**A Hall Industry Forum**

**Wednesday, 21 June 2023, 14:30-15:45**

**Session II: Interoperability and Platforms**

**Chair:** Raine Viitala

- **Software defined factory - requirements to industrial communication infrastructure**
  **Mika Skarp, Senior Product Manager, Cumucore Oy**

- **OPC UA based data harmonization**
  **Jouni Aro, CTO, Prosys OPC Ltd**

- **The importance of services in the success of automation product development projects**
  **Mikko Heikkilä, Customer Lead. Technology Key Account Manager, Beckhoff Automation**

- **Unleashing industry 4.0 thanks to hardware independent automation apps**
  **Greg Boucaud, Chief Marketing Officer, UniversalAutomation.Org**

- **Experiences with industrial interoperability standards and Model Broker**
  **Gerardo Santillan, Senior Specialist and Sales Manager, Semantum Oy**

- **Energy Flexibility Management - Platform, Solutions and Services**
  **Veikka Pirhonen, Director, Energy Flexibility Management, Siemens**

**Coffee break**

**Wednesday, 21 June 2023, 15:30-16:00**
**SESSIONS**

**B Hall IEEE IES strategy workshop**

Wednesday, 21 June 2023, 16:00-17:00

**E Hall WIP TT 13-3**

Wednesday, 21 June 2023, 16:00-17:30
Chairs: Larisa Dunai, Kostas Siozios

**PAPERS**

**16:00-16:20**

ISIE23-000203 Modeling and Control of Differential-Drive Chassis for a Homecare Assistive Robot

Ping He, Honghao Lv, Haiteng Wu, Geng Yang

**16:20-16:40**

ISIE23-000362 Headset gas sensor for monitoring of blood EtOH

Kohji Mitsubayashi, Shota Suzuki, Kenta Ichikawa, Kenta Iitani, Koji Toma, Takahiro Arakawa

**16:40-17:00**


Mikhail Kolesnikov, Jan Olaf Blech, Udayanto Dwi Atmojo, Valeriy Vyatkin, Maxim Afanasev

**17:00-17:20**

ISIE23-000380 Perturbation Device for Crutch Walk Training

Naoaki Tsuda, Ryosei Ikoma, Ryo Takahashi, Kodai Hayashi, Susumu Tarao, Yasunori Fujiwara, Yoshihiko Nomura, Norihiko Kato

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**Y228b SS 08-2**

Wednesday, 21 June 2023, 16:00-17:30
Chairs: Sally Sajadian, Hadi Kanaan

**PAPERS**

**16:00-16:20**

ISIE23-000246 Performance Comparison of Modulation Techniques for Modular Multi-level Converter

Anthony ABDAYEM, Jean Sawma, Flavia Khatounian, Eric Monmasson, Ragi Ghosn

**16:20-16:40**

ISIE23-000274 High-Dynamics P-E and Q-f Control of PV Inverters for Strong and Weak Grids

Ibai Urtasun, Andoni Urtasun, Luis Marroyo

**16:40-17:00**

ISIE23-000294 Modified Model Predictive Control for Power Balancing in Multilevel Inverter for Battery Energy Storage Applications

Henry Grote, Yuehao Zhu, Sally Sajadian

**17:00-17:20**

ISIE23-000319 Improved Transient Response in Inverter-Based Resources using Deep Reinforcement Learning

Ashwin Venkataramanan, Ali Mehrizi-Sani
C Hall WIP TT 05-10

Wednesday, 21 June 2023, 14:30-15:30
Chairs: Keith Corzine, Naira Goñi

PAPERS

16:00-16:20
ISIE23-000084 Fault Detection, Localization and Clearance for MMC based on Indirect Finite Control Set Model Predictive Control
Saad Hamayoon, Morten Hovd, Jon Are Suul

16:20-16:40
ISIE23-000248 A orientation tolerant wireless power transfer system using bipolar coil topology
Jure Domajnko, Rok Friš, Mitja Trunti, Nataša Prosen

16:40-17:00
ISIE23-000361 Demonstration of On-road Vehicle Drive with Electric Motor Fed by Power Packets
Shiu Mochiyama, Taketsune Nakamura

17:00-17:20
ISIE23-000390 High-fidelity averaged model of grid-following inverter for stability analysis considering the PLL influence
Naiara Goñi, Javier Marcos, Miguel García, Alberto García, Andoni Urtasun, Luis Marroyo

17:20-17:40
ISIE23-000397 A Z-Source Ac Circuit Breaker
Keith Corzine, Yuan Li, Fang Peng

A Hall Closing

Wednesday, 21 June 2023, 17:40-18:00