VPPC 2021
Connecting Green e-Motion

OCTOBER 25-28, 2021 | GIJÓN, SPAIN

VPPC 2021 CONFERENCE PROGRAM

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Pablo Arboleya
University of Oviedo, Spain

Feng Jianghua
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Welcome from the conference General Chairs

On behalf of the Organizing Committee, it is our great pleasure to welcome you to the 18th IEEE Vehicle Power and Propulsion Conference.

Our goal is to maintain the high scientific level of previous events and provide researchers in the field of electric mobility with a forum to discuss new ideas, and foster new alliances between researchers and also between academic institutions and industry. We consider that it is also very important to inspire and support the students as they will be in charge of designing the transport systems of the future under the premises of maximum efficiency, safety, and sustainability. With these objectives in mind, we have worked very hard to ensure that all those attending IEEE VPPC 2021 have as pleasant and productive an experience as possible.

We would not dare to carry out such an event, that has become the flagship conference for advanced transportation, without the support of an enthusiastic local committee, that together with the international collaborators, the technical program committee and the VPP Standing Scientific Committee, will bring their experience to guarantee the highest organizational and scientific quality.

Warmest Regards,

Pablo Arboleya, University of Oviedo, Spain
Feng Jinghua, CRRC, China
General Chairs, IEEE VPPC 2021

Welcome from the IEEE VTS President

On behalf of the IEEE Vehicular Technology Society, it is truly an honor and a pleasure to welcome all of you to the 2021 IEEE Vehicular Power and Propulsion Conference (IEEE VPPC 2021)! The conference theme this year is to connect green e-motion worldwide in a complete network.

This year's conference will provide attendees with a superb collection of keynote papers by authoritative speakers, technical sessions, tutorial sessions, poster sessions, special and invited sessions, and exhibitions that will facilitate the exchange of knowledge, enable professional development and growth, and support numerous networking opportunities with other conference attendees from around the world.

Please know that our thoughts are with those affected by the COVID-19 outbreak. The health and safety of our members, conference attendees, and volunteers is the utmost priority of our society. With the continuation of COVID-19 global health crisis, the VTS Board of Governors has decided to again convert IEEE VPPC 2021, originally planned to be held in the beautiful city of Gijon, to a fully virtual conference during the period of 25 October to 14 November 2021. We hope that the extended period of the conference enabled respected attendees from different parts of the world to access the rich program at their own convenient time. We do realize that virtual conference will not allow to reproduce the professional networking environment that you are used to, but it will allow IEEE VPPC 2021 to still attain a portion of its objectives.

Organizing a world-class conference event such as VPPC 2021 involves a large and highly dedicated team of volunteers, even when it is virtual, and we are very thankful to everyone for making this conference an outstanding success! I would like to sincerely thank the VPPC 2021 General Chair Pablo Arboleya, the Technical Program Co-Chairs Giambattista Gruosso, Ricardo De Castro, and Jorge Garcia, and the rest of the conference organizing team for their time, effort, dedication, and commitment for making VPPC 2021 one of the premier international conference events in vehicle power and propulsion!

Looking forward to meeting all of you at VPPC 2021 virtually this October!

With warmest regards,

Abbas Jamalipour
President, IEEE Vehicular Technology Society

Giambattista Gruosso
Politecnico di Milano
Italy

Ricardo De Castro,
University of California
Merced, United States

Jorge Garcia,
University of Oviedo,
Spain

The Technical Program Committee (TPC) is pleased to welcome all of you to the 18th IEEE Vehicle Power and Propulsion Conference (IEEE VPPC) in Gijon, for the second consecutive time, again proposed as virtual event due to the recent covid-19 pandemic.

State-of-art technical achievements and novel current research trends have been targeted and highlighted in the objectives of the program. The TPC committee, with the help of all track chairs, has finally put forward a notable program on key, relevant topics related to transportation and vehicular disciplines. During this IEEE VPPC edition, we organized: (i) 7 Regular Tracks covering many exciting aspects of vehicle power and propulsion (ii) 6 Special Sessions and (iii) a Recent Result Track. In addition, 5 Technical Tutorials are also part of the conference program. These organization achievements would not have been feasible without the valuable collaboration of all the track chairs involved (including Special Session Track chairs).

The technical program has been designed to address new, more advanced and interesting points of view on the challenges of a sustainable, more efficient mobility. The presentations will thus be online and are included into the program. All the accepted full papers will be fully published in the conference proceedings. In addition, the program offers outstanding keynotes, presented by renowned experts in electric and connected mobility.

The design of this program would not be possible without the voluntary and constant support from outstanding colleagues and staff, that we would like to warmly thank by their efforts. Many thanks to the TPC members, who have organized an effective review process with their professional and timely review or technical contributions. We would also like to thank to all the invited speakers, Special Session and Tutorial Chairs for organizing excellent sessions that will contribute with their latest insights to the conference attendees.

Last but not least, making a successful technical program cannot be achieved without the contributions of authors, to whom we would like to express our sincere gratitude for having decided to present and share their ideas and works to the VPPC community.

We would also like to thank the IEEE VPPC 2021 Organization and VPP TechCom for its full support along the preparation of the conference.

We look forward to meeting you again virtually in Gijon, Spain, from October 25th to November 14th.

TPC Chairs of IEEE VPPC 2021

Giambattista Gruosso
Politecnico di Milano
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Ricardo De Castro,
DLR German Aerospace Center,
Germany

Jorge Garcia,
University of Oviedo
Spain

Prof. Alain Bouscayrol,
University of Lille, France

Welcome from the chair of the VPPC steering committee

On behalf of the Vehicle Power Propulsion Conference (VPPC) steering committee, it is my great pleasure to welcome you to the 18th IEEE VPPC.

IEEE-VPPC'20 has been fully organized in a virtual mode due to the COVID-19 pandemic. But it was important to continue the dissemination of research activities. Unfortunately, the situation is not quite stable to have a normal conference this year, and the organizing committee, the VPP steering committee and VTS decided that **IEEE-VPPC'21** will be also a pure virtual conference to preserve safety and health of attendees. We hope to organize the next edition of IEEE-VPPC in presence for better scientific exchange and networking.

Special thanks to Prof. Abbas Jamalipour, VTS President, and Prof. J.R. Cruz, the VTS Conference chair, for their strong supports. Warms thanks to Cerry Leffler and Rodney Clint Keele (VTS Program Administrators) for their huge work in this difficult context. Kind thanks to Prof. Pablo Arboleya (University of Oviedo, Spain), VPPC'21 general chair, for his great effort to organize high-level event despite the context. Many thanks to Giambattista Gruosso (Politecnico di Milano, Italy), Ricardo de Castro (DLR, Germany) and Jorge Garcia (University of Oviedo, Spain), the Technical Program Committee co-chairs for their hard work to keep a high-level scientific program. **A key international conference needs a strong and dynamical international team** that can propose relevant adaptations in any context. We are lucky to have such a strong and dynamical team!

I hope you will enjoy the virtual VPPC'21, and I am looking forward to meeting you in-presence next edition!

Prof. Alain Bouscayrol
Chair of the VPPC steering committee

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Du Jiuyu, Tsinghua University, China

Track 2 – Power Electronics Motor Drives and Electric Power Systems
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Jian-Xin Shen, Zhejiang University, China
Jesús Doval, University of Vigo, Spain

Track 3 – Vehicular Electronics and Intelligent Transportation Systems
Sergio Saporana (Lead), University of Pisa, Italy
Sousso Kelouwani, Université du Québec à Trois-Rivières, Canada
Juan Diaz González, University of Oviedo, Spain

Track 4 – Control and Energy Management of Transportation Systems
Theo Hofman (Lead), Eindhoven University of Technology, Netherlands
Herschel C. Pangborn, Pennsylvania State University, USA
Jon Ander López, IKERLAN, Spain

Track 5 – Modeling, Analysis and Simulation of Transportation Systems
Joao Trovao (Lead), University of Sherbrooke, Canada
Sylvain Pagerit, Argonne National Laboratory, USA
Pablo Garcia Fernández, University of Oviedo, Spain

Track 6 – Charging Systems and Infrastructures
Rui Araújo (Lead), University of Porto, Portugal
Duy-Dinh Nguyen, Aichi Institute of Technology, Japan
Jose Antonio Aguado, University of Malaga, Spain

Track 7 – Hydrogen Refueling Infrastructures and Fuel Cell Vehicles
Daniel Hissel (Lead), Université de Franche-Comté, France
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SS2 – Electric (Battery, Fuel Cell and Hybrid) Buses
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SS3 – EMR and Other Graphical Descriptions
Co-chair: Kaibo Li, University of Lille, France
Co-chair: Thanh Vo-Duy, Hanoi University of Science and Technology, Vietnam

SS4 – Social, Economic and Societal Impact of Electro-mobility
Co-chair: Eric Hittinger, Univ. of Lille, France
Co-chair: Amandine Lepoutre, Univ. of Lille, France

SS5 – X-in-the-Loop Testing of Electrified Vehicles and Their Components
Co-chair: Valentin Ivanov, Technische Universität Ilmenau, Germany
Co-chair: Ronan German, Univ. Lille and MEGEVH Network, France

SS6 – IEEE VTS Motor Vehicles Challenge 2021 – Energy Management of a Dual-Motor All-Wheel Drive Electric Vehicle
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Co-chair: Joao P. Trovao, Université de Sherbrooke, Canada
Co-chair: Thanh Vo-Duy, Hanoi University of Science and Technology, Vietnam

SS7 – Virtual Components and Subsystems for Development of Innovative Electrified Vehicles
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Co-chair: Reinhard Tatschl, AVL List GmbH, Germany

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Moez BELHAOUANE (Centrale Lille)
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Mohsen Kandi (U. of Sherbrooke)
Morteza Mohammadi Shirkolaei (Shahid Sattari University of Aeronautical Engineering)
Muhammad Zeshan Alam (Université du Québec à Trois-Rivières)
Mylène Delhommais (Univ. Grenoble Alpes, CEA, Liten, DEHT,)
Nadir Idir (University of Lille)
Nakaret Kano (University of Birmingham)
Namdoo Kim (Argonne National Laboratory)
Nassim Noura (University of Québec at Trois Rivières)
Nayara de Freitas (INESC TEC)
Nerea Goitia-Zabaleta (IKERLAN)
Nguyen Thi Phuong Chi (University of Sherbrooke, Quebec, Canada)
Nikos Aletras (AUTH)
Ning Zhao (University of Birmingham)
Osvaldo González (Universidad Nacional de Asuncion)
Ottorino Veneri (National Research Council of Italy (CNR-STEMS))
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Pascal Messier (Université de Sherbrooke)
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Pedro Melo (School of Engineering, Polytechnic of Porto)
Phil Sharer (Argonne National Laboratory)

Reviewers-Continued

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Rafael Peña Alzola (University of Strathclyde)
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Ranjit Desai (NREL)
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Sinoun Phoung (Rochester Institute of Technology)
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Zhongbei Tian (University of Liverpool)
Zhongliang Li (Aix-Marseille University)
Zuqi TANG (University of Lille)

Workshop

Advanced Digitalization for Development of All Types of Electrified Vehicles and Components

Presenter: Alain Bouscayrol, Univ. Lille, PANDA project, France
Presenter: Valentin Ivanov, Tech. Univ. Ilmenau, XILforEV project, Germany
Presenter: Reinhard Tatschl, AVL, VISION-xEV project, Austria
Presenter: Enric Aramburu, Idiada, USPCALE project, Spain

Alain Bouscayrol received the Ph.D. degree in Electrical Engineering from Institut National Polytechnique de Toulouse, France, in 1995. From 1996 to 2005, he was Associate Professor at University of Lille, France, where he has been a Professor since 2005.

From 1998 to 2004, he managed the Multi-machine Multi-converter Systems project of GdR-ME2MS, national research program of CNRS (French National Centre of Scientific Research). From 2004 to 2019, he managed the national network on Energy Management of Hybrid Electric Vehicles (MEGEVH) France. Since 2015, he has been coordinator of the CUMIM (Campus of University with Mobility based on Innovation and Neutral carbon) interdisciplinary program of University of Lille. Since 2018, he has been co-director of the international research lab e-CAMPUS on sustainable mobility and also coordinator of PANDA a European H2021 project on simulation and testing of electrified vehicles.

His research includes graphical descriptions (Energetic Macroscopic Representation, etc.) for control of electric drives, renewable energy conversion systems, electrified vehicles and hardware-in-the-loop testing. His collaborative works with industry on energy management for vehicles include Siemens, PSA Peugeot Citroen, Valeo, Renault and SNCF. In January 2014, he has been nominated Chair of the Vehicle Power Propulsion technical committee by IEEE Vehicular Technology Society. From 2014 to 2018, he was Associate Editor of IEEE transactions on Vehicular Technology. Since 2016, has been elected Distinguished Lecturer by IEEE VTS.

Valentin Ivanov received the Ph.D. degree in 1997 and the D.Sc. degree in 2006 in Automotive Engineering from Belarusian National Technical University in Minsk, where he worked successively as Assistant, Associated and Full Professor. In 2007, as a Research Professor, he became an Alexander von Humboldt Fellow and in 2008 a Marie Curie Fellow with Technische Universität Ilmenau, Germany.

Currently he is working at TU Ilmenau with the Automotive Engineering Group as the coordinator of several European industrial-academic projects and Marie Skłodowska-Curie Actions. Valentin Ivanov is SAE Fellow, IEEE senior member, member of Society of Automotive Engineers of Japan and the Association of German Engineers. He is a recipient of SAE Ralph R. Teetor Educational Award and CADLM Intelligent Optimal Design Prize. His research fields are vehicle dynamics, electric vehicles, and automotive control systems.

Workshop-Continued

Reinhard Taschl is Research and Technology Manager in the business unit Advanced Simulation Technologies of AVL List GmbH. With about 4300 employees in Austria and more than 11500 worldwide, AVL is the world's largest independent company for development, simulation and testing technology of all kinds of powertrains for passenger cars, trucks and large engines. Reinhard graduated in Mechanical Engineering and received his PhD at Graz University of Technology. After his studies he joined AVL in 1991 as research engineer in the field of Computational Fluid Dynamics (CFD) modelling and simulation. From 2000 onwards Reinhard was heading the CFD software development team before taking over the current position as Research and Technology Manager in 2012.

Enric Aramburu is the IDIADA Fluid Engineering Product Manager and the Body Development department R+D manager. He holds a Mechanical Engineering degree and a Master in Numerical Methods applied to. His current responsibility is related with business development of the aerodynamics & CFD services within IDIADA. Mr. Aramburu has been working in the automotive industry for more than 25 years, as CFD engineer in companies such as SEAT, Simulogica or SENER Ingenieria & Sistemas. He joined IDIADA in 2004 and has participated in several R+D projects, such as, Supercalculus, Sartre, Convenient, Companion, Resolve, Domus, Cronuz or UPSCALE (project coordinator) and has been involved in more that 50 vehicle development programs with different automotive OEMs, such as, SEAT, AUDI, SKODA, GEELY, PSA Group, TOYOTA, TATA, GEELY, NISSAN, NIO, CNH-I, MAN, etc.. Besides his responsibilities as owner of the Fluid Engineering product, Mr. A is coordinating the Innovation activities within the Body Development department.

Abstract: Many H2020 projects are ongoing on the simulation of electrified vehicles. Four projects have been selected for the call LC-GV-02-20181 (Virtual product development and production of all types of electrified vehicles and components) These calls aim to propose significant advances in digitization leading to new opportunities for the automotive industry in terms of virtual product development and production, reducing the time-to-market of all types of electrified vehicles at lower costs.

This workshop aims to present the objective and recent development of the four H2020 projects of this call:

1) **PANDA** - Powerfull Advanced N-Level Digital Architecture for models of electrified vehicles and their components
Framework: Horizon 2020, GV-02-2018, GA # 824256
Coordinator: University of Lille, France
URL: https://project-panda.eu/

Workshop-Continued

PANDA aims to reduce the development time of electrified vehicles through standardization of the model/simulation, thereby enabling: 1) an easy reuse of models for different tasks and; 2) a reduction of the real testing of subsystems by virtual seamless testing. The main goal of the PANDA project is to provide unified organizations of digital models for seamless integration in virtual and real testing of all types of electrified vehicles and their components.

2) XILforEV - Connected and Shared X-in-the-loop Environment for EV Development
Framework: Horizon 2021, GV-02-2018, GA # 824333
Coordinator: TU Ilmenau, Germany
URL: https://xil.cloud/

XILforEV aims to develop a complex experimental environment for designing electric vehicles and their systems, which connects test platforms and setups from different domains and in different geographical locations. The project outcomes cover hardware and software components for xin the-loop environments, machine learning tools to improve real-time model accuracy and performance as well as high-confidence, real-time capable models with automatic validation using experimental data. The XILforEV technology is demonstrated for four use cases dedicated to the design of brake blending, ride blending, integrated EV chassis control and fail-safe EV powertrain control.

3) VISION-xEV - Virtual Component and System Integration for Efficient EV
Framework: Horizon 2021, GV-02-2018, GA # 824314
Coordinator: AVL, Austria
URL: https://vision-xev.eu/

VISION-xEV aims to develop and demonstrate a generic virtual component and system integration framework for the efficient development of all kinds of future electrified powertrain systems. The main goal is to develop novel high-fidelity reduced order models, related parameterization methodologies as well as interfacing and co-simulation methods to enable seamless coupling of models regardless of the underlying modelling platform. The VISION-xEV approach will be demonstrated for selected industrial use-cases related to the virtual development of future electrified powertrain systems.

Tutorials

T1—AMBER – Advanced Model Based Engineering Resource

Instructor: Phillip Sharer, Sylvain Pagerit, and Dominik Karbowski

Phillip Sharer is the team leader for the AMBER/Autonomie Systems Simulation Architecture. Before that, he was an Autonomie developer and co-author of PSAT. He has been a Research Engineer at Argonne for 22 years. He received a Master of Science in Engineering from Purdue University Calumet in 2002.

Sylvain Pagerit is a senior software & systems engineer in the Vehicle Modeling and Simulation group at Argonne National Laboratory. He received a Master of Science in Automatics, Control Systems and Industrial Engineering from the Ecole des Mines de Nantes, France, in 2000, as well as a Master of Science in Electrical and Computer Engineering from the Georgia Institute of Technology, Atlanta, in 2001. At Argonne, he focuses his work on the development of system simulation tools, originally for PSAT and Autonomie and now AMBER, as well as managing the group development environment. For the last 20 years, he also setup and manage High Performance Computer (HPC) clusters and design tools to facilitate and optimize system simulations on HPCs. He received a patent and several awards for his work on Autonomie and PSAT.

Dominik Karbowski is the Technical Manager of Intelligent Eco-Mobility, within the Vehicle and Mobility Simulation Group. He leads Argonne's effort to improve vehicle energy efficiency through control, data science, connectivity and automation, and using advanced systems simulation research.

Dominik is a major developer of simulation tools for transportation energy-efficient vehicle research. Dominik has made significant contributions to Autonomie, Argonne's road vehicle energy consumption tool, and has invented several software to support his research:

SVTRIP: Stochastic vehicle trip profile generation.
RoadRunner: Simulation of powertrain and longitudinal dynamics for energy-efficient CAV research.
Aeronomie: Dynamic aircraft simulation for energy and mission performance.
Dominik holds a master of science in engineering from Mines ParisTech (France).

Abstract: Most of today's R&D requires flexible multi-vehicle simulations involving CAVs, ADAS, regional transportation, large-scale and others. Those simulation workflows are getting more and more difficult to manage, and require to constantly set up and switch between multiple tools. The resulting complex workflows get difficult to standardize and distribute. AMBER was created to provide a platform of completely open and customizable workflows, and enables engineers and researchers to retake control of their MBSE workflows. The attendees will be provided with a free version of AMBER using compiled vehicles for the hands on part of the tutorial. Matlab must be installed on the participant computers to run the simulations.

Tutorials

T2 - SIC Reliability Testing for Automotive and Traction Applications

Instructor: Francesco Iannuzzo

Francesco Iannuzzo received the M.Sc. degree in Electronic Engineering and the Ph.D. degree in Electronic and Information Engineering from the University of Naples, Italy, in 1997 and 2002, respectively. He is primarily specialized in power device modelling.

He is currently a professor of reliable power electronics at the Aalborg University, Denmark, where he is also part of CORPE, the Center of Reliable Power Electronics. His research interests are in the field of reliability of power devices, including mission-profile based life estimation, condition monitoring, failure modelling and testing up to MW-scale modules under extreme conditions. He is author or co-author of more than 230 publications on journals and international conferences, three book chapters and four patents. Besides publication activity, over the past years he has been contributing 17 technical seminars about reliability at first conferences as ISPSD, EPE, ECCE, PCIM and APEC.

Prof. Iannuzzo is a senior member of the IEEE (Industry Application Society, Reliability Society, Power Electronic Society, and Industrial Electronic Society). He currently serves as Associate Editor for the IEEE Journal of Emerging and Selected Topics in Power Electronics, Transactions on Industry Applications, the EPE Journal, and Elsevier Microelectronics Reliability. He is vice-chair of the IEEE IAS Power Electronic Devices and Components Committee. In 2018 he was the general chair of the 29th ESREF, the first European conference on the reliability of electronics, and has recently been appointed general chair for the EPE 2023 conference in Aalborg.

Abstract: The tutorial introduces the modern principles of testing for reliability of modern power electronic components. After a short introduction about CORPE – the center of Reliable Power Electronics at Aalborg University, expectations from power electronics industries will be presented. Some reliability theory fundamentals will be given, along with practical details about common testing protocols. Wear/life testing types will be then presented and classified, each with its specific aim. The last part will be about the original test approach at Aalborg University used for Silicon Carbide MOSFETs, which are becoming very appealing for the automotive market. Some prospects about failure analysis will conclude the tutorial.

T3 - Understanding the Science and Engineering of Electric Vehicle Battery Safety

Instructors: Xuning Feng and Jorge Varela Barreras

Xuning Feng, Assistant Professor with School of Vehicle Mobility, Tsinghua University. Research interest include the battery safety for electric vehicle: characterization and modelling, and the battery system for electric vehicle: state estimation, thermal management, fault diagnosis. My research objectives are to solve engineering science problems that are pertinent to the application of new energy vehicles; to develop technologies to enable safe and efficient operation of electrochemical power sources; and to bridge the technology gaps between basic science of cell materials and commercial vehicle applications by developing methodologies and tools for battery characterization and management. My major contributions in engineering science include 1) conceived and developed technologies and methodologies for preventing thermal runaway of large-format lithium-ion traction batteries. 2) Pioneered in adiabatic thermal runaway test of large-format lithium-ion traction batteries, making the thermal runaway behavior measurable. 3) Established thermal runaway initiation and propagation models for the safety design of battery pack, making the thermal runaway behavior predictable. 4) Developed online diagnosis algorithm for battery degradation and internal-short-circuit, making the battery state-of-health online evaluable. 5) Implemented and validated most of the strategies and algorithms on industrial battery systems, demonstrated their effectiveness.

Jorge Varela Barreras, Senior Researcher with Imperial College London, and Joint Chair of IEEE UK & Ireland Education Society. My current research interests are: electro-thermal battery modelling and characterization, advanced battery balancing systems, BMS and HV battery pack design and testing, battery diagnosis and prognosis methods, derating power strategies, proactive and reactive strategies for battery safety management, and novel EV and BESS architectures. My main research goal is to develop experimental and modelling tools that enable decarbonisation of the energy sector and transportation at a global scale and bring academic knowledge into industry and policymakers. So far, my major contributions in the field are: 1) a multi-awarded novel EV architecture based on fixed and swappable battery packs; 2) multi-awarded theoretical and practical developments of a new generation of active balancing systems, i.e. multi-objective smart and hybrid balancing systems; 3) pioneering works in BMS testing on hardware-in-the-loop simulators; 4) introduction of a number of simplified methods for electrical battery modelling; 5) development of EV battery safety training courses for emergency response services and industry; 6) guest editor of a special issue in EV battery safety in eTransportation by Elsevier.

Abstract: This tutorial presents and discusses an introduction to EV battery safety technology, from both a theoretical and a practical perspective, focusing on proactive and reactive safety measures, and covering design, modelling, analysis, testing, or battery management system related issues. The tutorial is divided into two different parts. In the first part, we start from the basics, giving definitions and classifications around EVs, lithium-ion battery systems and management systems. Then we introduce the principles of safety philosophy and lay down the safety terminology. Next, we list and describe the different EV battery safety hazards, including explosive, flammable, oxidizing, electrical, chemical, or heat hazards. In the second part, we review practical state-of-the-art approaches to improve safety, covering both proactive and reactive strategies to prevent and control the risks. For each hazard, we present and discuss practical safety measures at different levels (cell to vehicle and environment) and product life cycle stages.

T4 - State of Health Determination of Lithium-Ion Batteries: Mechanistic Modeling Approach

Instructor: David Anseán, University of Oviedo, Spain

David Anseán received the M.Eng. degree from the University of Granada, (Spain), in 2007, and the Ph.D. degree (with honors) from the University of Oviedo, (Spain), in 2015, both in electronics engineering.

Before pursuing his PhD, he gained international industry experience (Basingstoke, U.K., and Berkeley, CA, USA) in technological companies. As a doctoral student, he was the recipient of a research fellowship stay at the Electrochemical Power Systems Laboratory, at the University of Hawaii, USA, which he later joint as a Postdoctoral Fellow, to work in Dr. Dubarry's group on advanced diagnosis and prognosis techniques on lithium-ion batteries on.

Since 2016 he is an Assistant Professor at the University of Oviedo, where he is the instructor of undergraduate and graduate courses including power electronics, digital integrated circuits, and embedded systems. His research interests include lithium-ion battery degradation mechanisms analysis via non-invasive methods, battery testing and characterization, and design of battery fast charging.

In 2018 and in 2019 he was the recipient of Visiting Scholar Research Fellowships and joined the Institute for Power Electronics and Electrical Drives (ISEA) at RWTH Aachen University (Germany), and the Electrochemical Power Systems Laboratory, at the University of Hawaii, (USA), respectively.

Abstract: The tutorial will first cover the fundamentals of lithium-ion batteries to gain the required knowledge on cell degradation mechanisms. Then, we will provide the necessary tools, concepts and best practices to both carry out the battery laboratory testing for in-situ aging mode identification and the battery model construction. We then present how linking battery testing data with reconstructed modeling allows us to decipher both qualitatively and quantitatively the underpinning aging modes ongoing on a given battery. These findings lead to battery diagnosis and prognosis. The last part will be interactive and feature live analysis using Matlab®-based toolbox, specifically designed to simplify the use of these techniques, help diagnose the Stat of Health and identify and quantify the underlying degradation modes. Attendees will be able to adopt a pro-active attitude during a hands-on toolbox demonstration, as part of this short course.

T5 - Real-Time Simulation in the Hardware-in-the-Loop Environments

Instructors: Dragan Zuber and Philippe Barrade

Dragan Zuber is a business developer at Typhoon HIL for almost 8 years already and he's a veteran when it comes to HIL technology

Dr. Philippe Barrade (member of the IEEE) received the Ph.D. degree in Electrical Engineering in 1997 from INP, Toulouse, France. In 1998, he was working at SAFT, in the field of power electronics and energy management for UPS applications. From 1999 to 2014, he was Senior Scientist, Lecturer at Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland.

Since 2015, he is Professor at the University of applied Science, HES-SO Valais, Switzerland. His main research fields are power electronics applications, energy management and storage, including Multiphysics systems modelling. He develops actually a strong activity of real-time simulation and hardware-in-the-loop simulation, linked to methodologies for systems virtual design.

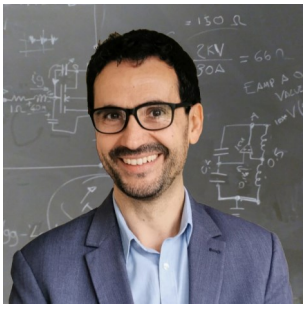
Abstract: The first part of the tutorial will cover the Typhoon HIL real-time simulation capability brief, presented by Dragan Zuber. The second part will be dedicated to examples in using real-time simulators in hardware-in-the-loop environments, presented by Dr. Philippe Barrade.

Basic example will be provided first in the frame of pedagogical activities, aiming in pre-testing control algorithms on real-time simulators before deporting such a control on a real device. More advanced design methodologies will be introduced, using HIL systems in replacement of conventional simulation tools to design simultaneously a power conversion structure and its dedicated control. This part will be concluded with basis on co-simulation, aiming at coupling with HIL devices other simulation tools to constraint the system to be studied.

Keynotes

Francesco Iannuzzo , Professor, Reliable Power Electronics, Aalborg University, Denmark

Title: "Implication of Wear and Abnormal Events on The Reliability of SiC MOSFETs for Automotive"



Francesco Iannuzzo is currently a professor at the Aalborg University, Denmark, where he is also part of CORPE (Center of Reliable Power Electronics). His research interests are in the field of reliability of power devices, including mission-profile-based life estimation, condition monitoring, failure modeling, and testing up to MW-scale modules under extreme conditions, like overvoltage, overcurrent, overtemperature, and short circuit. He is the author or co-author of +250 publications on journals and international conferences, three book chapters, and four patents. He has edited the recently-published Modern power electronic devices: physics, applications, and reliability book. Besides publication activity, over the past years, he has been invited for several technical seminars about reliability at first conferences as ISPSD, EPE, ECCE, PCIM, and APEC. Prof. Iannuzzo is the founder of the newborn Power Electronic Devices and Components journal with Elsevier and serves as Associate Editor for IEEE Transactions on Industry Applications, IEEE Journal of Emerging and Selected Topics in Power Electronics, and Elsevier Microelectronics Reliability. He is the vice-president of the IEEE IAS Power Electronic Devices and Components Committee. He was the general chair of ESREF 2018, the 29th European Symposium on Reliability of Electron Devices, Failure physics, and analysis, and has been appointed EPE-ECCE Europe General Chair in 2023.

Abstract: Thanks to the unprecedented potential in terms of efficiency compared with silicon counterparts, silicon carbide (SiC) devices have quickly become an enabling technology for Electric Vehicles. However, the critical manufacturing process required to fabricate SiC MOSFETs raises concerns for long-term reliability. On top of that, short-circuit is one of the most critical aspects because of the huge power density compared to e.g., silicon IGBTs.

The speech presents first the degradation indicators under both wear and short-circuit conditions. Afterwards, an original mixed power-cycling/short-circuit test approach is presented, to investigate the implications of short-circuit events on the expected life. Results of failure analysis (lock-in thermography, focused ion beam, and scanning electron microscope) are also presented along with a transient thermo-mechanical simulation based on finite-element analysis. Finally, a mitigation strategy to enhance short-circuit robustness is proposed.

Keynotes

Pietro Tricoli , Senior Lecturer, Department of Electronic, Electrical, and Systems Engineering, University of Birmingham, Birmingham, U.K.

Title: "Railways in the Era of Decarbonisation – Future Challenges of Traction Power Systems"

Dr. Pietro Tricoli is currently a Senior Lecturer in electrical power and control with the Department of Electronic, Electrical, and Systems Engineering, University of Birmingham, Birmingham, U.K. He has authored more than 100 scientific papers published in international journals and conference proceedings (h-index 22) and has a research portfolio worth £1.5M supported by ESPRC, EC, Innovate UK and industry. His current research interests include the modelling of storage devices for road electric vehicles, railways, and rapid transit systems, wind and photovoltaic generation, railway electrification systems and the modelling and control of multilevel converters. Pietro is a member of the IEEE Industrial Electronics Society and the Energy Institute. He is the Web and Publication Chair of the International Conference on Clean Electrical Power. He is the Deputy Editor-in-Chief and Feature Editor of the IET Journal Renewable Power Generation. He is a Registered Professional Engineer in Italy.

Abstract: Electrification of the railway allows for faster, greener, more reliable train journeys, improves passenger services and supports economic growth in Britain. These are because electric trains are faster and quieter than diesel trains and have a much reduced carbon emissions. Therefore, significant investments are currently ongoing around the world to increase the proportion of electrified railways. This will lead inevitably to an increase of the demand of railway traction power supplies, which are single-phase ac and, hence, undesirable for the public grid. It is likely that in the future a large proportion of electric railway will require static compensators to meet the requirements on the negative phase sequence, which are due to become even more stringent in the future for the higher penetration of renewable energy sources. It is therefore essential that future electric railways are better integrated with the power grid, rather than be seen as a simple unbalanced load. This could be done by introducing power electronics for the traction power supplies, energy storage and new data management systems for the intelligent interconnection with the public grid.

This talk focusses on new advanced power converters for traction power supply achieving a high level of interconnection with energy storage and also providing ancillary services for the grid. Medium voltage DC systems will be also considered as a subsequent step to the introduction of static frequency converters. Finally, the challenges of the interconnection of traction systems to DC grid for electric vehicle rapid charging will be discussed

Keynotes

Alberto Méndez Rebollo , CPO, Vattenfall, Sweden

Title: "The Role of the Grid in the Energy Transition, Orchestrating and Enabling a Full-electric, Fossil-free World"

Alberto Méndez Rebollo is an executive, investor and entrepreneur who has dedicated his entire career to "the energy transition". Alberto has held executive and board positions at leading corporations, startups and international organizations such as Siemens-Gamesa, Vattenfall, XCharge and Procurement Leaders where he has built and run multibillion ventures and operations in areas like wind and solar power, electricity grids and e-mobility. Alberto is co-founder and chairman of Plexigrid, a revolutionary startup developing the Operating System for tomorrow's electricity grids.

Abstract: Electrical distribution systems are suffering these days a change of paradigm, to accommodate new technologies like distributed generation or electric vehicles. We started introducing the term microgrid 20 years ago and this was the starting point for a major change. In the new distribution systems, all agents can take active roles in the network, and it is possible the interactions between different levels of the whole power system by means of the so-called Aggregators. In order to implement these solutions that allow high levels of penetration of flexible technologies as electric vehicles, energy storage, heat pumps, … the grid should be ready to be monitor and operated in real time and incorporate transactive energy tools enabling the active participation of all agents or devices. The role of the aggregator will be in charge of this coordination between agents allowing the coordination between different power system agents and levels (transmission, distribution, market …). In this speech, will review the current situation of the network, describing the difficulties and barriers that exist for the implementation of this disruptive concept and motivating its necessity. We will look in depth at existing catalysts that will make the development of this paradigm critical in the short term and the enabling technologies that will make it viable.

VPPC 2021 Program at a Glance

Live Events

Monday, October 25		
8:00 am– 11:00 am CDT USA	T1—AMBER—Advanced Model Based Engineering Resources	The AMBER & Autonomie workshop will be an interactive stream via Microsoft Teams
3:00pm—6pm DST Europe	Presented by Phillip Sharer, Sylvain Pagerit, and Dominike Karbowski	
Wednesday, October 27		
8:00 am– 12:00 pm CDT USA	Workshop - The Advanced Digitalization for Development of All Types of Electrified Vehicles and Components	This workshop will be presented live.
3:00pm—7pm DST Europe	Presented by Alain Bouscayrol, Valentin Ivanov, Reinhard Tatschl, and Enric Aramburu	

IEEE VEHICLE POWER AND PROPULSION CONFERENCE PROGRAM

Program at a Glance - Technical Sessions by Session in the Mock Schedule

Session Title	Date in Mock Schedule
Lithium Ion Battery Technology	Monday, 25 October
Storage Systems	Monday, 25 October
Energy Storage and Generation, Components and Systems	Monday, 25 October
Special Session: Electrical Railways Systems Dashboard: Traction Systems	Monday, 25 October
Special Session: Electrical Railways Systems Dashboard: Vehicles	Monday, 25 October
Special Session: IEEE VTS Motor Vehicles Challenge 2021	Monday, 25 October
Session - Control and Energy Management of Electrified Vehicles	Tuesday, 26 October
Session - Hybrid Vehicles	Tuesday, 26 October
Session - Control of Converters	Tuesday, 26 October
Session - Converters	Tuesday, 26 October
Special Session: EMR and Other Graphical Descriptions: Vehicles	Tuesday, 26 October
Special Session: Social, Economic and Societal Impact of Electro-mobility: Other	Tuesday, 26 October
Special Session: Social, Economic and Societal Impact of Electro-mobility: Vehicles	Tuesday, 26 October
Charging Systems and Infrastructures	Wednesday, 27 October
Wireless Charging Systems	Wednesday, 27 October
Hydrogen Fueling Infrastructure and Fuel Cell Vehicles	Wednesday, 27 October
Analysis of Transportation Systems	Wednesday, 27 October
Modeling of Traction Systems	Wednesday, 27 October
WBG Devices for Transportation Applications	Wednesday, 27 October
Sensors, Devices and Protections	Thursday, 28 October
Recent Results: Traction Systems	Thursday, 28 October
Recent Results: Vehicles	Thursday, 28 October
Special Session: X-in-the-Loop Testing of Electrified Vehicles and Their Components	Thursday, 28 October
Special Session: Virtual Components and Subsystems for Development of Innovative Electrified Vehicles	Thursday, 28 October
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Energy Storage and Generation, Components and Systems: Lithium Ion Battery Technology

Session Co-chairs - Marie-Cécile Péra and Juan Carlos Viera

Cycling study of 18650 Nickel-Rich Silicon-Graphite Lithium-Ion Batteries under different charge currents Jorge Alonso-del-Valle, Manuela González, Juan Carlos Viera, Víctor García, David Anseán, University of Oviedo, Spain.	2021004192
Experimental comparison of fast-charging protocols for NMC and NCA Li-ion batteries Shubham Sharad Bhoir, Claudio Brivio, Emil Namor, Andreas Hutter, R&D, CSEM S.A., Switzerland.	2021004213
Investigation and Modelling of Temperature-Dependent Current Distributions Within Lithium-Ion Batteries for Real-Time Applications Sebastian Menner, Michael Buchholz, Ulm University, Germany.	2021004004
Module-Level Modelling Approach for a Cloud-based Digital Twin Platform for Li-Ion Batteries Olatz Lizaso-Eguileta, Egoitz Martinez-Laserna, Mikel Rivas, Basque Research and Technology Alliance (BRTA), Spain; Eduardo Miguel, Unai Iraola, Mondragon Unibertsitatea, Spain; Igor Cantero, Cegasa Energía, Spain.	2021004227
State of Health Estimation using Machine Learning for Li-ion battery on Electric Vehicles Thusitha Asela Bandara, J.C. Álvarez Antón, Manuela González, David Anseána, Juan Carlos Viera, University of Oviedo, Spain.	2021004302
Study of lithium-ion battery ageing cycled with current profiles from railway applications Charles Lorenzo, Romain Tabusse, David Bouquain, Daniel Hissel, Université de bourgogne Franche-Comté, France|Samuel Hibon , Alstom, France.	2021004261

Energy Storage and Generation, Components and Systems: Storage Systems

Session Co-chairs - Ali Sari and João Trovão

Impact of standardization applied to the diagnosis of LT-PEMFC by Fuzzy C-Means clustering Damien Chanal, Nadia Yousfi Steiner, Didier Chamagne, Marie-Cécile Pera, Femto-ST Institute, France.	2021004086
Li-ion battery State-of-Charge estimation using computationally efficient neural network models Pedro Monteiro, Rui Araújo, University of Porto, Portugal; Cláudio Pinto, Continental Engineering Services, Unipessoal Lda., Portugal; Stephan Matz, Continental Engineering Services GmbH, Germany.	2021004288
Modification of Degradation Mechanism Identification Technique for Cell Grading Sadia Tasnim Mowri, Warwick Manufacturing Group, University of Warwick, United Kingdom.	2021004648
Ragone plot-based method for sizing an Electric Vehicle's Battery-Battery Hybrid Energy Storage System (HESS) Caio Fonseca de Freitas, Patrick Bartholomeus, Xavier Margueron, Philippe Le Moigne, L2EP, Ecole Centrale de Lille, France.	2021004141
Voltage-Based State of Charge Correction at Charge-End Ali Abdollahi, Jianwei Li, Xiaojun Li, Trevor Jones, Asif Habeebullah, Gotion Inc., United States	2021004094

Power Electronics, Motor Drives and Electric Power Systems: Energy Storage and Generation, Components and Systems

Session Co-chairs - Nadir Idir and Philippe Barrade

2D finite element model of the Audi e-Tron induction motor Hugo Husson, Robin Thomas, Lauric Garbuio, Grenoble Electrical Engineering Laboratory, Univ. Grenoble Alpes, CNRS, Grenoble INP, France.	2021004231
A high-speed air compressor controller for vehicle used fuel cell systems Qian Zhang, Jianqiu Li, Shuai Mao, Zunyan Hu, Liangfei Xu, Tsinghua University, China; Hongjie Zhang, Southeast University, China.	2021004166
Dynamic and Static characterization of the absorption process in metal hydride tanks for Mobile Applications Santiago Hernán Suárez, Djafar Chabane, Abdoul N'Diaye, Youcef Ait-Amirat, Abdesslem Djerdir, Univ. Bourgogne Franche-Comté, UTBM, CNRS, France.	2021004080
Modular Simulation of Zonal Architectures and Ring Topologies for Automotive Power Nets Laurenz Tippe, Lisa Pilgrim, Hans-Georg Herzog, Technical University of Munich (TUM), Germany; Joachim Fröschl, EE, BMW Group, Germany.	2021004074
Numerical simulation of squirrel cage induction machine Zvonimir Petranovic, Peter Urthaler, Sarah Santner, Clemens Fink, AVL List GmbH, Austria.	2021004167
Open-End Winding Permanent Magnet Synchronous Machine With Winding Connection Change Method for High Efficiency EV Traction Soo-Hwan Park, Kyoung-Soo Cha, Sung-Woo Hwang, Jae-Hyun Kim, Myung-Seop Lim, Hanyang University, South Korea.	2021004162
Temperature Prediction of Ultra-High-Speed SPMSM for FCEV Air Compressor Considering PWM Current Harmonics So-Yeon Im, Soo-Hwan Park, Jae-Hyun Kim, Jun-Woo Chin, Kyoung-Soo Cha, Myung-Seop Lim, Hanyang University, South Korea.	2021004164

Special Session: Electrical Railways Systems Dashboard: Traction Systems

Session Co-chairs - Zhongbei Tian and Zedong Zheng

Cost-effectiveness of Opportunity Charging in Non-electrified Railway Lines Josu Olmos, Andoni Saez-de-Ibarra, Haizea Gaztañaga, Ikerlan Technology Research Centre, Basque Research and Technology Alliance (BRTA), Spain; Dimas Lopez, Txomin Nieva, CAF Power and Automation, Spain; Iosu Aizpuru, Mondragon Unibertsitatea, Spain	2021004236
Defining the Operational Cost of En-Route Platoon Formation Scenarios Evan Pelletier, Sean Brennan, Pennsylvania State University, United States.	2021004292
Energy Cost Optimization in DC Railway Traction Systems Considering Degraded Scenarios Alba Jimenez, Peru Bidaguren, Turnkey & Engineering, CAF , Spain; Pablo Arboleya, University of Oviedo, Spain.	2021004076
Hardware-in-the-loop simulation of auxiliary power system based on adjoint network method Chen Liusong, Zhang Yu, Zhang Zhaoyang, Wang Jili, Liu Li, The simulation technology, CRRC ZIC Research Institute of Electrical Technology & Material Engineering, China; Yang Li, Hunan Railway Professional Technology College, China.	2021004193
Research on Super-layer Image Detection Method for Rail Flaw Hao Yuan, Jun Lin, Qunfang Xiong, Wei Yue, Yanghan Xu, Quandong Wang, CRRC Zhuzhou Institute Co., Ltd., China.	2021004136
Research on Fault Diagnosis Method of Rolling Bear Lv Peng, Wang Xu, CRRC ZhuZhou Institute CO.,LT, China.	2021004124

Special Session: Electrical Railways Systems Dashboard: Vehicles

Session Co-chairs - Zedong Zheng and Zhongbei Tian

A study to determine the preferred locations of inverting substation for light DC railways Zhongbei Tian, University of Liverpool, United Kingdom; Tamer Kamel, Pietro Tricoli, University of Birmingham, United Kingdom; Mansoureh Zangiabadi, Neal Wade, Volker Pickert, Newcastle University, United Kingdom.	2021005230
Active Noise Cancellation of Rail Vehicles Based on a Convolutional Fuzzy Neural Network Prediction Approach Tao Li, Yuyao He, Ning Wang, Kaihui Zhao, Hunan University of Technology, China; Jianghua Feng, CRRC Zhuzhou institute Co., Ltd., China; Weihua Gui, Central South University, China.	2021004068
In-depth Life Cycle Cost Analysis of a Hydrogen Electric Multiple Unit Josu Olmos, Andoni Saez-de-Ibarra, Haizea Gaztañaga, Ikerlan Technology Research Centre, Basque Research and Technology Alliance (BRTA), Spain; Dimas Lopez, Txomin Nieva, CAF Power and Automation, Spain; Iosu Aizpuru, Mondragon Unibertsitatea, Spain.	2021004211
Predicting Traction Energy Demand of a Light Rail Vehicle Using Deep Learning Methods Markus Tesar, Stefan Müller-Broich, Lars Hilmer, Peter Gratzfeld, Karlsruhe Institute of Technology, Germany.	2021004005

Special Session: IEEE VTS Motor Vehicles Challenge 2021

Session Co-chairs - Bao Huy Nguyen and João Trovão

Efficiency-Based Energy Management Strategy of a Dual-Motor All-Wheel Drive Electrical Vehicle Marzio Barresi, Silvia Colnago, Luigi Piegari, Politecnico di Milano, Italy.	2021004276
Energy Management of A Dual-Motor All-Wheel Drive Electric Vehicle Based on the Minimum Power Losses Criteria Agustin Bucciarelli, José Luis Saavedra, Universidad Nacional de Rafaela, Argentina; Diana Sofía Mendoza, Javier Solano, Universidad Industrial de Santander, Colombia; Cristian H De Angelo, Universidad Nacional de Río Cuarto, Argentina	2021004148
Energy Management of a Dual-Motor Electric Vehicle Based on Particle Swarm Optimization Elia Scolaro, Diego Troncon, Luigi Alberti, University of Padova, Italy.	2021004040
How to Win the 2021 IEEE VTS Motor Vehicles Challenge With a Pragmatic Energy Management Strategy Helder Pereira, Rui E. Araujo, University of Porto, Portugal; Ricardo de Castro, University of California, Merced, United States.	2021004256
IEEE VTS Motor Vehicles Challenge 2022 - Sizing and Energy Management of Hybrid dual-Energy Storage System for a Commercial Electric Vehicle Thanh Vo-Duy, Hanoi University of Science and Technology, Vietnam; João Trovão, Minh C.Ta, University of Sherbrooke, Canada; Samir Jemeï, Univ. Bourgogne Franche-Comté, France; Loïc Boulon, Université du Québec à Trois Rivières, Canada; Alain Bouscayrol, Université de Lille, France	2021004251
Optimal Energy Management for a Dual-motor All-wheel Drive Electric Vehicle Considering Battery Temperature Yitao Wu, Jie Li, Zhihang Chen, Yonggang Liu, Chongqing University, China; Zhenzhen Lei, Chongqing University of Science & Technology, China; Zheng Chen, Kunming University of Science and Technology, China.	2021004172
Optimal Traction Power Distribution Strategy for Dual-motor Electric Vehicles Truong-Minh Doan, Thanh Vo-Duy, Hanoi University of Science and Technology, Vietnam; Minh C.Ta, e-TESC Laboratory, University of Sherbrooke, Canada.	2021004243

Control and Energy Management of Electrified Vehicles

Session Co-chairs - Suosso Kelowani and Herschel Pangborn

Ecological Predictive Cruise Control of Connected Electric Vehicle with Predecessor Velocity Prediction and Road Grade Preview Yichen Zhou, Weichao Zhuang,Southeast University, China; Fei Ju, Nanjing University of Science and Technology, China.	2021004091
Energy-optimal Design and Control of Electric Vehicles' Transmissions Juriaan van den Hurk, Mauro Salazar, Eindhoven University of Technology, Netherlands.	2021004226
Glocal Energy Management System with Optimal Torque-Flux and Speed Controllers Binh Minh Nguyen, Michihiro Kawanishi, Toyota Technological Institute, Japan; Minh Ta Cao, João Pedro Trovão, University of Sherbrooke, Canada.	2021004113
Kernel Regression for Energy-Optimal Control of Fully Electric Vehicles Marcel Menner, Stefano Di Cairano, Mitsubishi Electric Research Laboratories (MERL), United States.	2021004139
Performance Investigation of Torque Vectoring Topologies for Electric Vehicles' Motorway Tire Fault Conditions Thomas Statheros, Jakub Kopiec, Brandon Ballard, Coventry University, United Kingdom.	2021004260
Study on the Torque-Speed Allocation on PMSM to Improve Energy Efficiency in Electric Vehicles Using Metaheuristic Optimization Juan Diego Valladolid, Fabricio Espinoza, Universidad Politecnica Salesiana, Ecuador; Diego Patino, Pontificia Universidad Javeriana, Colombia; Giambattista Gruosso, Politecnico di Milano, Italy.	2021004332

Control and Energy Management of Electrified Vehicles: Hybrid Vehicles

Session Co-chairs - Du Jiuyu and Pablo García

A Deep Deterministic Policy Gradient-Based Energy Management Strategy for Fuel Cell Hybrid Vehicles Chunhua Zheng, Wei Li, Yao Xiao, Chinese Academy of Sciences, China; Dongfang Zhang, East China Normal University, China; Suk Won Cha, Seoul National University, South Korea.	2021004165
Analytical approach for sensitivity analysis of hybrid electric vehicle design Xavier Huin, Michael Di Loreto, Eric Bideaux, Ampère, INSA Lyon, France; Hellal Benzaoui, Volvo Group, France.	2021004374
Convex Optimization of Speed and Energy Management System for Fuel Cell Hybrid Trains Rabee Jibrin, Stuart Hillmansen, Clive Roberts, Ning Zhao, University of Birmingham, United Kingdom; Zhongbei Tian, University of Liverpool, United Kingdom.	2021004063
Deep Reinforcement Learning Based Energy Management Strategy for Fuel Cell and Battery Powered Rail Vehicles Kai Deng, Di Hai, Hujun Peng, Kay Hameyer, RWTH Aachen University Germany; Lars Löwenstein, Siemens Mobility GmbH, Austria.	2021004046
Real time Performance Estimation for Energy Management of a Fuel Cell Hybrid Electric Vehicle Nassim Noura, Loïc Boulon, University of Quebec in Trois Rivieres, Canada; Samir Jemei, University of Franche Comte, France.	2021004237
Singular Fuel-optimal Control of the Velocity and Power-split of Hybrid Electric Vehicles via Pontryagin's Minimum Principle Thijs van Keulen, Mauro Salazar, Eindhoven University of Technology, Netherlands.	2021004051

Power Electronics, Motor Drives and Electric Power Systems: Control of Converters

Session Co-chairs - Andrés Barrado Bautista and Z.Q. Zhu

A Selective Order Voltage Ripple Suppression Control Strategy for DC-DC Converter Li Bing Zhang, Zhuzhou CRRC Times Electric Co., China.	2021004149
Battery-Electric Powertrain Design Analysis for an Efficient Passenger Vehicle Julien Duclos, Theo Hofman, Eindhoven University of Technology, Netherlands.	2021004188
Control and Power Sharing Strategy of Dual Three-Phase Permanent Magnet Synchronous Motor for Light Railway Applications Nursaid Polater, Tamer Kamel, Pietro Tricoli, University of Birmingham, United Kingdom.	2021004247
Control Strategy to Provide Frequency Support Functionality Using a Supercapacitor-Based Energy Storage System Jhonatan D. Paucara, Jose Carlos U. Peña, Damian Sal y Rosas, Rafael Espinoza, Universidad Nacional de Ingenieria, Peru.	2021004296
Multi-source Bidirectional Quasi-Z-source Inverter using Fractional Order PI Controller for Electric Traction System Mande Daouda, Joao Pedro Trovao, Ruben Gonzalez-Rubio, Minh Ta Cao, University of Sherbrooke, Canada.	2021004259

Power Electronics, Motor Drives and Electric Power Systems: Converters

Session Co-chairs - Jesús Doval and Mircea Ruba

Analysis of Interleaved Input-Parallel Output-Parallel Dual-Active-Bridge Converter for More Electric Aircraft Alejandro Fernandez-Hernandez, Asier Garcia-Bediaga, Irma Villar, Ikerlan Technology Research Centre, Spain; Gonzalo Abad, Mondragon Unibertsitatea, Spain.	2021004158
Design and Analysis of a Partial-Power Converter with an Active Power-Buffer for a Fuel Cell-based Hybrid Electric Vehicle Jesus Sergio Artal Sevil, Victor Ballestin-Bernad, Jose Luis Bernal-Agustin, University of Zaragoza, Spain; Alberto Coronado-Mendoza, University of Guadalajara, Mexico.	2021005058
High-Gain Non-isolated DC-DC Partial-Power Converter for Automotive Applications Jesus Sergio Artal-Sevil, Victor Ballestin-Bernad, Jose Antonio Dominguez-Navarro, University of Zaragoza, Spain; Jon Anzola, Mondragon Universitatea, Spain.	2021005092
Low-volume and high-efficiency converter solution for interfacing a Hybrid Energy Storage System (HESS) Çaio Fonseca de Freitas, Patrick Bartholomeus, Xavier Margueron, Philippe Le Moigne, Ecole Centrale de Lille, France.	2021004142
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Ultra-Versatile Power Converter based on a Multi-Winding Flyback Transformer for EV Application Miroslav Vasic, Universidad Politécnica de Madrid (UPM), Spain; Asier Garcia-Bediaga, Ander Avila, Alejandro Rujas, Itziar Alzuguren, Ikerlan Technology Research Centre (BRTA), Spain.	2021004171

Special Session - EMR and Other Graphical Descriptions: Vehicles

Session Co-chairs - Kaibo Li and Thanh Vo-Duy

Energetic Macroscopic Representation and Inversion-Based Control of a Multi-Level Inverter with Integrated Battery for Electric Vehicles Clément MAYET, Denis LABROUSSE, Rihab BKEKRI, Gaël PONGNOT, ENS Paris-Saclay, France; Francis ROY, STELLANTIS, France.	2021004184
Influence of Electric Vehicle Charging on Lithi-um-ion Batteries Aging Alla Ndiaye, Ronan German, Alain Bouscayrol, Elodie Castex, University of Lille, L2EP, France; Pascal Venet, University of Lyon 1, France.	2021004217
Inversion-based Control of Scaled PMSM for Battery Electric Vehicles Ayoub Aroua, Walter Lhomme, Alain Bouscayrol, University of Lille & Ghent University, France; Florian Verbelen, Kurt Stockman, Ghent University, Belgium.	2021004201
Model Reduction of a Fuel Cell Vehicle using Energetic Macroscopic Representation under Simcenter Amesim Achref Elkamel, Daniela Chrenko, Fei Gao, Univ. Bourgogne Franche-Comté, France; Eduard-Edis Raclaru, Brasov, Siemens Industry Software SRL, Romania; Walter Lhomme, Univ. Lille, France.	2021004155
Model Simplifications of a Subway Vehicle for Computation of Energy Consumption Ryan O. Berriel, Philippe Delarue,Philippe Delarue, Alain Bouscayrol, Univ. Lille, France; Charles Brocart, EVOLUTION DU METRO, Métropole Européenne de Lille, France.	2021004651
Modeling of an EV air conditioning system for energetic studies in summer David Ramsey, Alain Bouscayrol, University of Lille, France; Loic Boulon, University of Quebec a Trois-Rivieres, Canada.	2021004196
Optimal Energy Management of a Dual-motor Electric Vehicle using Dynamic Programming Hoai-Linh T. Nguyen, Son Nguyen-Van, Tri Hoang Xuan, Thanh Vo-Duy, Hanoi University of Science and Technology, Vietnam; Bao-Huy Nguyen, Minh C.Ta, University of Sherbrooke, Canada.	2021004244
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Special Session - Social, Economic and Societal Impact of Electro-mobility: Other

Session Co-chairs - Amandine Lepoutre and Eric Hittinger

A Brief Overview on Commercial Aircraft Electrification: Limits and Future Trends Gianluca Delogu, Mario Porru, Alessandro Serpi, University of Cagliari, Italy.	2021004239
Analysis of the peak grid load reduction using ECO-charging strategy for e-bus fleets in Gothenburg Mohammed Mahedi Hasan, Mohamed El Baghdadi, Omar Hegazy,Vrije Universiteit Brussel, Belgium|Andoni Saez-de-Ibarra, Basque Research and Technology Alliance, Ikerlan Technology Research Centre, Spain.	2021004255
Comparisons of GHG emissions of on-site working and teleworking: case study of a research group Alain BOUSCAYROL, Nord, University of Lille, France	2021005089
Electrification of Commercial Vessels: Pilot Projects and Open Issues Francesco Cherchi, Mario Porru, Alessandro Serpi, University of Cagliari, Italy.	2021004241
Life Cycle Assessment of Lithium-ion Battery Pack: Implications of Second-life and Changes in Charging Electricity Michael Samsu Koroma, Daniele Costa, Maarten Messagie, Vrije Universiteit Brussel, Belgium; Giuseppe Cardellini, Flemish Institute for Technological Research (VITO), Belgium.	2021004002

Special Session - Social, Economic and Societal Impact of Electro-mobility: Vehicles

Session Co-chairs - Eric Hittinger and Amandine Lepoutre

Calculation of the GHG emissions of a European research project on electrified vehicles Amandine Lepoutre, Alain Bouscayrol, University of Lille, France; Cristi irimia, Calin Husar, Siemens Romania, Romania||Theodoros Kalogiannis, Vrije Universiteit Brussel, Belgium|Mariam Ahmed, Valeo, France|Claudia Martis, Technical University of Cluj-Napoca, Romania|Dragan Zuber, Typhoon HIL, Serbia|Damien Phetsinorath, Engineering, TUV SUD, Germany|Fei Gao, UTBM, France|Wieteke van Balen, UNR, Netherlands; Adrian Birtas, RTR, Romania|Johan Lecoutere, Bluways, Belgium	2021004233
Carbon Impact Methodology for PV-powered Infrastructure for Recharging Electric Vehicles Saleh Cheikh-Mohamad, Manuela Sechilariu, Fabrice Locment, Université de Technologie de Compiègne, France.	2021004176
Consultation on elecro-mobility in the framework of a living lab Eugénie Masclef, Elodie Castex, Alain Bouscayrol, University of Lille, France; Sylvie Miaux, Loic Boulon, Université du Québec à Trois-Rivières, Canada.	2021004214
Tradeoffs Between Trip Duration and Cost for Electric and Thermal Vehicles Mohamed Medmoun, Anatole Desreveaux, El Mostapha Sabir, University of Lille, France; Eric Hittinger, Rochester Institute of Technology, United States.	2021004248

Charging Systems and Infrastructures

Session Co-chairs - Rui Araujo and Walter Lhomme

A Novel Fast Charger Architecture with Reduced Impact on Distribution Grids Based on V2V Power Transfer Yacine SEHIMI, Vedecom Institute / L2EP; Jihen Sakly, Vedecom Institute; Khaled Almaksour, Benoit Robyns, L2EP	2021005731
Artificial Scenario Generator for the Impact Study of Electric Vehicle Charging on the Distribution Grid Komal Khan, Islam El-Sayed, Pablo Arboleya, University of Oviedo, Spain.	2021004190
Double Coupling IPT Systems for EV Charging Applications Marina Perdigao, Instituto de Telecomunicações, Portugal; Emanuel Marques, Valter Costa, André Mendes, University of Coimbra, Portugal; Miguel Torres, Bruno Rios, Polytechnic Institute of Coimbra, Portugal.	2021005211
Intelligent Electric Vehicle Charging Controller Filipe Cardoso, Filipe Caldeira, Pedro Baptista, Viseu Polytechnic - ESTGV, INESC Coimbra, Portugal; José Rosado, Marco Silva, Carlos Teixeira, Cristina Agreira, Francisco Barreto, Paulo Pereirinha, Coimbra Polytechnic - ISEC, INESC Coimbra, Portugal.	2021004093
Operating Grid-Forming Control on Automotive Reversible Battery Charger Antoine BRUYERE, Yorgo LABA, Xavier GUILLAUD, EEA, L2EP - Centrale Lille, France; Frederic COLAS, -, L2EP - Arts et Metiers, France; Benedicte Silvestre, Valeo Siemens e-Automotive, France.	2021004041
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Session Co-chairs - Duy-Dinh Nguyen and Marina Perdigao

Comparison of Two Power Factor Correction Topologies on Conducted Emissions in Wireless Power Transfer Systems for Electric Vehicles Amelie Burkert, Benedikt Schmuelling, University of Wuppertal, Germany.	2021005007
Metamaterial and AI-based Parameter Optimization for Efficient Wireless Power Transfer Webster Adepoju, Indranil Bhattacharya, Muhammad Bima, Tennessee Technological University, United States.	2021004392
Neural Network Based Mutual Inductance Estimation for Maximum Power Point Tracking in Wireless Power Transfer Array Muhammad Enagi Bima, Indranil Bhattacharya, Webster Adepoju, Tennessee Technological University, United States.	2021004547
Redundancy and Fault-Tolerant Design of Rotational MIMO Wireless Power Transfer System De'an Wang, Yongkang Qiao, Jiantao Zhang, Zhi Bie, Xinyu Zhang, Shumei Cui, Kai Song, Chunbo Zhu, Harbin Institute of Technology, China.	2021004100
Vehicle Modelling During Emission Measurement of Wireless Charging Stations Using a Passive Impedance Network Sebastian Jeschke, Michael Kleinen, Marcel Olbrich, Joerg Baerenfaenger, EMC Test NRW GmbH, Germany; Amelie Burkert, Benedikt Schmuelling, Myrel Tiemann, University of Wuppertal, Germany.	2021004210

Hydrogen Fueling Infrastructure and Fuel Cell Vehicles

Session Co-chairs - Daniel Hissel and Loïc Boulon

Adaptive Eco-driving of Fuel Cell Vehicles Based on Multi-light Trained Deep Reinforcement Learning Bo Liu, Chao Sun, Qingyun Min, Biao Liang, Beijing Institute of Technology, China; Qiang Ren, Guangzhou Automobile Group Co., Ltd, China; Xiaodong Wei, Hunan University, China.	2021004203
Comparative Study of Three Cost Functions for a Fuel Cell Hybrid Electric Vehicle Mohsen Kandidayeni,João Trovão, University of Sherbrooke, Canada; Alvaro Macias, Loïc Boulon, Université du Québec à Trois-Rivières, Canada.	2021004049
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Hierarchical Energy Management of Fuel Cell Vehicles Through Signalized Intersections Xiaodong Wei, Hunan University, China; Chao Sun, Bo Liu, Qingyun Min, Weiwei Huo, Beijing Institute of Technology, China; Qiang Ren, Guangzhou Automobile Group Co., Ltd, China.	2021004208
Hydrogen Minimization of a Hybrid Multi-Stack Fuel Cell Vehicle Using an Optimization-Based Strategy Mohammadreza Moghadari, Loïc Boulon, Université du Québec à Trois-Rivières, Canada; Mohsen Kandidayeni, Université de Sherbrooke, Canada; Hicham Chaoui, Carleton University , Canada.	2021004053
Quadratic Programming based Energy Management in a Multi-Stack Fuel Cell Hybrid Electric Vehicle Razieh Ghaderi, Loïc Boulon, UQTR, Canada; Mohsen Kandidayeni, João Pedro Trovão, University of Sherbrooke, Canada.	2021004253
SoC Planner for Predictive Energy Management of Fuel Cell Vehicles Qingyun Min, Chao Sun, Biao Liang, Bo Liu, Beijing Institute of Technology, China; Xiaodong Wei, Hunan University, China; Qiang Ren, Guangzhou Automobile Group, China.	2021004238

Modeling, Analysis and Simulation of Electrified Vehicles: Analysis of Transportation Systems

Session Co-chairs - Valentin Ivanov and Jose Antonio Aguado

3D Thermal and 1D Electro-Thermal Model Coupling Framework for Lithium-Ion Battery Cells in Automotive Industry Platforms Ashkan Pirooz, Joeri Van Mierlo, Maitane Berecibar, Vrije Universiteit Brussel, Belgium.	2021004182
Design and Performance Analysis of Multi-axle Independent-drive Heavy-duty Fuel Cell Vehicles Jiayi Hu, Kehan Yan, Jianqiu Li, Shucheng Liu, Zunyan Hu, Liangfei Xu, Minggao Ouyang, Tsinghua University, China.	2021004131
Hot-start based Fast Speed Planning for Eco-Driving of Intelligent Vehicles Jianghao Leng, Chao Sun, Sifan Wang, Hui Zhang, Beijing Institute of Technology, China.	2021004204
Interest and method to evaluate the evolution of the DC bus voltage in a hybrid system during the preliminary design by optimization Essolizam PLANTE, Mylène DELHOMMAIS, Mathias GERARD, Daniel CHATROUX, Université Grenoble Alpes, France; Eric BIDEAUX, Université de Lyon, INSA de Lyon, France.	2021004220
On-line Test of a Real-Time Velocity Prediction for E-bus Energy Consumption Estimation Camiel Beckers, Igo Besselink, Henk Nijmeijer, Eindhoven University of Technology, Netherlands.	2021004066
Optimizing Range and Efficiency in Autonomous EVs: The Role of the Time Horizon Eduardo Mello, Peter Bauer, University of Notre Dame, United States.	2021004249

Modeling, Analysis and Simulation of Electrified Vehicles: Modeling of Traction Systems

Session Co-chairs - Paulo Pereirinha and Aymeric Rousseau

1D Dynamic Thermal Model Development for a Battery Hybrid Thermal Management System Eneko Gonzalez-Aguirre, Iñigo Aranburu, Jon Gastelurrutia, Luis Diaz, IKERLAN Technology Research Centre, (BRTA), Spain; Mahesh Suresh Patil, Vrije Universiteit Brussel, Belgium|Luis del Portillo-Valdes, University of the Basque Country, Spain	2021004206
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Analysis of parallel connected lithium-ion cells imbalanced performance based on electrothermal modelling environment Gabriele Piombo, University of Warwick, United Kingdom; James Marco, University of Warwick, United Kingdom|Richard Boyd, Altair Engineering Ltd., United Kingdom	2021004252
Measuring and Characterization of a Pedal Electric Cycle (Pedelec) Drivetrain on a Test-Bench for Modelling and Optimization Simon Decker, Lars Leister, Andreas Liske, Martin Doppelbauer, Michael Schmitt, Karlsruhe Institute of Technology (KIT), Germany.	2021004221

Power Electronics, Motor Drives and Electric Power Systems: WBG Devices for Transportation Applications

Session Co-chairs - Ke Li and Kimimori Hamada

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