EV2019 PROGRAM

Thursday (03 Oct.)	Icpe Club	ShowRoom	All Electric	Main Hall	Icpe Solar Park
08:30 - 09:30	Welcome Coffee and Registration				
09:30 – 12:00	Opening Plenary				
12:00 – 12:40	Coffee Break				
12:40 – 12:45		Workshop 2 (PANDA)			
12:45 – 14:00	Emobility Experience				
14:00 – 14:40	Lunch				
14:40 – 15:00					Exposhow - Launch Drawing Contest -
15:00 – 16:30	S1	S2	S3	Poster Session	EXPO & Test Drive
16:30 – 16:45	Coffee Break				
16:45 – 18:15	Workshop 1 (INTERACT)	S4	S5		
18:15 – 18:45					
18:45 – 19:00	Coffee Break				Attitude 5 Awards
20:00 – 23:00	Gala Dinner				

Friday (04 Oct.)	Icpe Club	ShowRoom	All Electric	Main Hall	Icpe Solar Park
09:00 – 09:30	Welcome Coffee and Registration				EXPO & Test Drive
09:30 – 11:30	Plenary Session				
11:30 – 11:45	Coffee Break			Poster Session	
11:45 – 13:15	S6	Round Table (DIT UK)	EV Owners Meeting		
13:15 – 14:15	Lunch				
14:15 – 16:45		Workshop 3			

Opening Plenary
Thursday – 03.10.2019 (09:30 – 12:00)
Location: Icpe Club

Moderator:
Nicolae MOCIOI
Secretary General AVER

Virgil RACICOVSCHI	**CEO Icpe**
Mihai NEACŞU	**President AVER**
Marian PETRACHE	**President of Ilfov County Council**
Robert NEGOIŢĂ	**Municipality Mayor of District 3**
Mircea CAZAN	**Senator – Committee on Communications and Information Technology**
George Cătălin STÂNGĂ	**Senator – Committee on Environment**
Nicolae HURDUC	**Ministry of Research and Innovation**
Carlos BARRIOS	**First Secretary – Embassy of Peru in Romania**
Nicuşor BUICĂ	**CEO – SIF Muntenia**
Cornel BREZUICĂ	**President of Environment Fund Administration (AFM)**
Dan Marian COSTESCU	**Former Minister of Transportation**
Jayson DONG	**Policy Officer AVERE**
Petar GEORGIEV	**Policy Advisor for Climate and Electro-mobility policy at Eurelectric**
Lucian TOMA	**Vice Chair IEEE Romania**
Valentin NĂVRĂPESCU	**Vice Rector and Professor at Politehnica University of Bucharest**
Harm WEKEN	**CEO – FIER Automotive & Mobility**
Annick ROETYNCK	**Manager – LEVA-EU**
Gerfried JUNGMEIER	**Key researcher on "Future Energy Systems and Lifestyle" at JOANNEUM RESEARCH in Graz Austria**
Eric SERRE	**Expert Power Electronic Reliability – RENAULT TECHNOLOGIE ROUMANIE**
Codruţ Ştefan NICOLAU	**General Manager – Patria Bank**
Daniel PREDA	**Branch Manager – Libra Internet Bank**

Emobility Experience
Thursday – 03.10.2019 (12:45 – 14:00)
Location: Icpe Club

Moderator:
George BUHNICI
CEO of Cavaleria.ro

Bogdan Ovidiu VARGA	**Automotive Engineering and Transport Department - Scientific coordinator for acquisition of 41 electrical buses for Cluj-Napoca municipality**
Ioan GÂF-DEAC	**City Manager Bucharest 4th District Hall**
Bogdan ENOIU	**CEO – McCann Worldgroup Romania**
Iordan TONCHEV	**General Manager – Spark Romania**
Csibi MAGOR	**Head of Leadership and Organizational Cultural Practice at Trend Consult Group**
Raluca DĂNULESCU	**Marketing Director – Autoklass**

Plenary Session
Friday – 04.10.2019 (09:30 – 11:30)
Location: Icpe Club

Moderator:
Camelia Cristina SPĂTARU
Founder Jump to SMART-ERomania
Vice President Romanian Association of Public Relations (ARRP)

Bruno LEBRUN	**CEO – Gireve**
Doina DRAGOMIR	**Technical Officer – Romanian Standards Association (ASRO)**
Bogdan DUMITRAŞCU	**Sales Manager – Nexans Romania**
Martin WOOD	**Supply Chain Specialist | Automotive Team | Technology, Entrepreneurship & Advanced Manufacturing | Global Trade & Investment Department for International Trade (DIT)**
Lawrence FREEMAN	**Senior Counsel – Bird & Bird**
Andrei MARINESCU	**ASTR-Technical Sciences Academy of Romania, Full Member**
Liviu POPESCU	**General Manager Automotive Industry / AVER Member**
Bjorn UTGARD	**Director of New Markets EVBOX**
Richard STOCKER	**HORIBA MIRA Ltd.**
Dickehage MORITZ	**SmartLab, ELaadNL, E-Clearing.Net**

Workshop 1 – Key component technologies in EMs and power electronics, and their integration into advanced system (**INTERACT**)

Thursday (03 Oct.) / 16:45 – 18:45

Location: Icpe Club

Description: The trend for more electrified automotive applications (MEAA) asks for a new generation of automotive electrical actuation systems, allowing for a more efficient and environmentally friendly mobility and enhancing the driving experience, making it safer, more comfortable and sustainable. INTERACT's overall objective is to answer the further enhancement of the next generation high-performance sustainable automotive electric actuators (SAEA) by combining high-level scientific research and training activities in a joint academia-industry doctoral programme, focused on solving critical issues (See Section 1.1.2) of the automotive electrical actuation Research & Development (R&D) cycle. The project is a natural continuation of a fruitful collaboration between the beneficiaries: two universities (UTCN and ULB) and three industrial actors. What started as staff exchange collaboration for technological know-how and transfer of knowledge in the field of electrical machines and drives for automotive applications, is now developed, through INTERACT, into a joint doctoral programme, based on common interests and goals, in the field of R&D of next generation of SAEA. More specifically, INTERACT takes advantage of the well-established intersectoral collaboration achievements and of the solid research and training competences and facilities at the beneficiaries for: (i) giving new career perspectives and increasing the employability of four young researchers, by enhancing their creative and innovative potential; (ii) pushing forward and/or extend the industrial partners portfolio with new technological developments to be integrated into the R&D process so they remain and/or enter as an important player in automotive industry ; (iii) strengthen innovation capacity of UTCN and ULB with commercial exploitation of the research.

Workshop 2 – **P**owerfull **A**dvanced **N**-Level **D**igital **A**rchitecture for models of electrified vehicles and their components (**PANDA**)

Thursday (03 Oct.) / 12:40 – 14:40

Location: ShowRoom

Description: The automotive market is undergoing disruptive changes. Whilst electrified vehicles represented only 0,1% of the market in 2015, the number of electrified vehicles sale has doubled from 2014 to 2015 (from 600.000 to 1,2 Millions) and is expected to grow massively in the coming decade. The automotive industry needs to adopt a new approach for this transition, because the development process of cars will fundamentally change. Traditionally manufacturers of internal combustion engines (ICEs) develop and assemble engines and transmissions (to a certain extent) independently form car manufacturers. The development is different in electrified powertrains, as it is more complex to integrate all electrified systems in the vehicle design.

The PANDA project makes this fundamental change easier by developing a method to organise and interconnect models for all electrical vehicle components. A common framework (based on Energetic Macroscopic Representation) will solve the problems of incompatibility between different models from different organisations, physical domains and levels of accuracy. PANDA intends to play a leading role in the development of software tools and methods for improving the virtual generation of new products, new technologies and of integrate virtual development to supports the complete generation of a new electrified vehicles.

The project is funded by the European Commission in the Research and Innovation Action.

11 Organisations from 7 different EU countries will work together to reduce the development time (time-to-market) by 20% 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.

Drawing Contest - Launch

Thursday (03 Oct.) / 14:40 – 15:00

Location: Icpe Solar Park

Description: By participating in this project, children have learned through specific methods for their age and understood the implications of the conventional transport and the importance of developing the “electric vehicles” field for mankind. We discovered ingenious green transport solutions seen through the eyes of the next generation.

Attitude 5 Awards Thursday (03 Oct.) / 18:45 – 19:00
Location: Icpe Solar Park
Description: The most appreciated drawings made by children will not remain not rewarded and will receive our appreciation. The winning drawing of the grand prize will be used as a graphic symbol of the EV2019 event. The ideas of the children surprised us, so we invite you to support them during this event. Come and discover ingenious ecological transport solutions seen through the eyes of the next generation.

Poster Session Thursday (03 Oct.) / 15:00 – 19:00 Friday (04 Oct.) / 11:30 – 16:45
Location: Main Hall
Description: Poster session is a great opportunity to meet and establish professional future fruitfully activities between the authors and you. The scientific papers are presented in an informal context and unlike a traditional oral session, all of the posters are set up at once and each presenter is expected to stand with their poster and answer questions from passers-by. The quality of the scientific papers from the poster session is equal with the scientific papers which are presented during oral sessions so, don`t miss the opportunity to get in contact with authors with deep knowledge in electric mobility.

EXPO & Test Drive Thursday (03 Oct.) / 15:00 – 18:45 Friday (04 Oct.) / 09:00 – 16:45
Location: Main Hall
Description: As a part of the conference the exhibition is to indicate the level of the emobility market in Romania edition by edition. Key representative auto makers, charging infrastructure companies, micromobility shareholders, drivers, will present their portfolio and their enthusiasm for this new type of sustainable transportation with the audience and the professional.

Round Table (DIT UK) – How the UK can help local companies move up the value chain

Friday (04 Oct.) / 11:45 – 13:15

Location: ShowRoom

Description: UK companies are keen to assist local businesses develop their technology. Central Europe has been hugely successful in terms of manufacturing both cars and car components. However, all Central European countries see the need to move up the value chain and develop their own products.

We would like to propose the UK automotive industry as your technology development partner to help your companies add value to their products. As a technology partner, the UK has a number of crucial advantages. The UK is uniquely equipped to lead the international automotive sector. Our strengths include a highly integrated innovation infrastructure, dedicated R&D programmes, world leading research universities and several globally renowned engineering and development consultancies, such as HORIBA MIRA, Millbrook and Ricardo. Focusing on specific areas– autonomous driving, low carbon propulsion, and the use of lightweight materials – has also enabled the UK to excel. The UK is also home to the world's most active specialist vehicle sector, and is a recognized world leader in engineering and design consultancy – services which continue to increase in demand, as cars become ever more complex. As well as sourcing quality products, our international partners also have significant opportunities to benefit from the expertise, training and consultancy services provided by UK companies. Join us at this unique session chaired by Mr. Martin Wood, Supply Chain Specialist, Department for International Trade (DIT) to find out more about opportunities for collaboration, the UK strategy for Clean Growth, Megatrends in R&D, funding opportunities, technology parks in the UK and much more.

Limited places available. Please express your interest at emanuela.cristescu@fco.gov.uk.

EV Owners Meeting – Association meet-up of Tesla Motors Fans Romania

Friday (04 Oct.) / 11:45 – 13:15

Location: All Electric

Description: EV owners in Romania gather to support emobility, share experiences, lobby, organize workshops, test drives and develop the community. Socialize among the members. Promoting green transportation. Joining together for a sustainable future.

Workshop 3 – Efficient Drive Systems for Electric Mobility – ICPE ACTEL

Friday (04 Oct.) / 14:15 – 16:45

Location: ShowRoom

Description: R&D on electric mobility

Thursday – 03.10.2019

S1 – Electric Vehicles
15:00 – 16:30
Location: Icpe Club

Moderators:
1 – Johan J. C. GYSELINCK
2 – Daniel FODOREAN

1	*Comparative study between PMSM models used for NVH system-level simulation* Jose Enrique Ruiz Sarrio, Sebastian Ciceo, Fabien Chauvicourt and Claudia Martis Presenter: Jose Enrique Ruiz Sarrio	**Abstract** - Modeling of automotive Permanent Magnet Synchronous Machines (PMSM) electric drives for Noise, Vibration and Harshness (NVH) assessment involves modeling different components such as electrical machine, power electronics and controller. The usage of transistors for machine control affects the NVH performance, especially within the switching frequency range. Traditionally the method to include power electronics models is to use co-simulation to couple a circuit simulator with an electromagnetic Finite Element (FE) model. However this approach is computationally expensive. To overcome this limitation, the electromagnetic behavior of the machine can be approximated by using reduced order models. This work compares the co-simulation approach with the system-level model in terms of high frequency NHV behavior. The comparison provides results in terms of time and accuracy.
2	*Numerical Modeling of the Soft Magnetic Composite Material* Shruti Singh, Yves Mollet and Johan Gyselinck Presenter: Shruti Singh	**Abstract** - Besides conventional laminated steel, softmagnetic composites (SMC) have been developed in the past decades to be used in electrical machines because they provide an isotropic 3-D magnetic flux path and eddy current losses are possibly lower when compared with laminated steel. This paper aims at analyzing the magnetic properties of SMC material using finite element (FE) model, in order to determine its macroscopic complex permeability in function of frequency. This allows saving computation time in more complex FE model by using an equivalent homogeneous material. A 2-D model is provided, comprising regular iron grains and non-conductive gaps. Eddy current losses in the grains are then computed in the frequency domain, neglecting magnetic saturation of the SMC material.
3	*Dynamic Modeling of Dual-star Permanent-magnet Synchronous Machines Using Look-up Tables* Abdolmajid Abedini Mohammadi, Johan Gyselinck and Adrian-Cornel Pop Presenter: Abdolmajid Abedini Mohammadi	**Abstract** - A flux linkage-based dynamic model of a dualstar surface-mounted permanent-magnet synchronous machine (PMSM) is developed. The relation between flux linkages, phase currents and rotor position is studied in the rotor reference frame considering three different phenomena, namely saturation, cross-saturation, and magnetic saliency. Four different methods for the characterization of the dual-star PMSM are presented. The two first methods are based on the calculation of d- and q-axis inductances, which are suitable for lumped-parameter modeling, while the two others are based on look-up tables (LUTs). In third model the complete characterization of the machine using proper LUTs considering previously mentioned phenomena is done. Then, a method for the characterization of the dual-star PMSM using only one of the stars with more compact LUTs is presented. Finally, various identification methods are compared in terms of accuracy, complexity, and computation time. Moreover, transient FE simulation results are included and compared with the results of the presented models.

4	*Lumped Parameter Thermal Modeling of Permanent Magnet Synchronous Motor* Andrej Kačenka, Adrian-Cornel Pop, Ioana Vintiloiu and Daniel Fodorean Presenter: Andrej Kačenka	**Abstract** - Permanent magnet synchronous motors (PMSMs) are often used in automotive applications due to their high power density. In the design process of electrical machines, the analysis of heat transfer is of equal importance as their electromagnetic one, because the temperature rise of the machine eventually determines the maximum output power with which it is allowed to be constantly loaded. Overheating in PMSM has a negative impact on the machine due to the phenomenon of demagnetization of the Permanent Magnets (PMs) as well as due to the thermal ageing of insulation. This paper deals with the thermal modeling of PMSM using Lumped Parameter Thermal Network (LPTN) and FE (Finite Element) model. Through analogy with the electrical circuits, the thermal network of the machine consists of thermal resistances and thermal capacitances. The power losses are represented in this equivalent circuit by current sources. Each part of the machine is represented by a node. Based on the intended node locations, the machine has been divided into sub-elements for which the thermal resistances and capacitances have been calculated by using Matlab-script for different geometric shapes. The temperature rise of the machine has been calculated by solving the network using two electrical circuits simulators, namely LT-spice and Matlab- Simulink.
5	*Homogenization of Multi-turn Windings in Electrical Machines with Fewer Number of Conductors* Muhammad Usman Hassan, Hugo Carlier, Johan Gyselinck and Yves Mollet Presenter: Muhammad Usman Hassan	**Abstract** - AC copper losses are very prominent in high speed electrical machines. Finite element method (FEM) can be used to calculate these losses when modelling each turn of the winding. However, homogenization of windings is generally done to reduce the computational cost of these models. An analytical approach combined with homogenized FEM, is proposed in literature to calculate losses in the frequency domain, considering that each turn is surrounded by a layer of conductors. This paper investigates the accuracy of the approach for lower number of conductors, i.e. when this hypothesis does not hold. For this purpose, results generated by fine and homogenized models are compared.
6	*Homogenization of the Winding in Thermal Finite Element Modelling of Electrical Machines* Hugo Carlier and Johan Gyselinck Presenter: Johan Gyselinck	**Abstract** - This paper explores a thermal homogenization method and its impact on the temperature distribution in a realistic electrical motor geometry. The homogenization method combines a geometrical part and the estimation of equivalent physical properties for the homogenized winding region. A good agreement in both hot spot temperature and position is found between homogenized and non-homogenized models. On top of that, the robustness of this method for a slot with a low number of wires and some randomness in their position is evaluated as well.

S2 – Infrastructure for electric mobility
15:00 – 16:30
Location: ShowRoom

Moderators:
1 – Tiberiu TUDORACHE
2 – Liviu POPESCU

1	*A Novel High Efficiency Hybrid Power Unit for Hydrogen-Fueled City Transit Bus* Antonio Ometto, Carlo Masciovecchio, Fabrizio Ciancetta and Gino D'Ovidio Presenter: Gino D'Ovidio	**Abstract** - The paper presents the analysis of a hydrogenfueled city transit bus with 'zero' emission. The vehicle power train is based on electric motors fed by a novel and high efficiency hybrid power unit composed by a functional coupling of a hydrogen fuel cell stack and a set of kinetic energy storage systems at high speed. The transit bus has been simulated by means of a numerical model by using the worldwide harmonized drive cycle for light-duty vehicle test procedure. The implemented parametric model calculates the traction power requirement, by starting from the speed profile, taking into account both system and path parameters (vehicle characteristics, load factor and path features). Each component of the power train is modelled separately and validated with experimental data from literature. Specific fuel consumptions and emissions for the traction are compared with the ones of a similar diesel motorized transit bus in the same operating conditions. The results highlight that the proposed hybrid power unit allows a significant fuel and CO2 emission saving to be achieved.
2	*On-road Charging System Demonstrator for EVs* Tiberiu Tudorache, Andrei Marinescu and Ionel Dumbrava Presenter: Tiberiu Tudorache	**Abstract** - This paper presents a review of the existing charging technologies for EVs, followed by a presentation of a proposed solution based on several distributed transmitter coils supplied by parallel resonant inverters sequentially energized depending on the position of receiver coil mounted on the vehicle. Then a reduced scale demonstrator with an energized lane of several meters, containing the elements of a real system, will be presented. Numerical 3D simulations are used to calculate the parameters of the inductive charging system and their variation with the EV position as well as the energy transfer efficiency. Parts of the numerical results are experimentally validated.
3	*Autonomous vehicles' safety in mixed traffic: Accounting for incoming vehicles when overtaking* Dan M. Costescu Presenter: Dan M. Costescu	**Abstract** - The author builds on his previous work on formalization the traffic rules, to keep the autonomous vehicles (AV) legally accountable when planning and performing different maneuvers, employing a methodology based on Legal, Logic and Engineering Analyses to assess the safety of overtaking in mixed traffic. As the overtaking models were developed by now only for setups like Operational Designed Domain which is a controlled, known in advance environment, or for simplified scenarios as overtaking on highways with traffic separated by medians, the present paper developed a model able to account for the incoming traffic when overtaking, extending the applicability range from highways to the complex situation of urban streets or rural roads, two-ways and undivided traffic. Aiming to facilitate the translation of formulas expressed in Linear Temporal Logic to High Order Logic Languages, a series of definitions and theorems were developed, variables as time/distance-to-collision and time/distance-for-overtaking calculated, and finally the predicates as safe-distance-incoming, avoid-head-on-collision or safe-lateral-distance were assessed. The model fills another literature gap as well, by introducing variable speeds and acceleration during overtaking.

		Three control strategies emerged from these model's control functions: Passive, Reactive and Pro-active Control Strategies able, for different condition and extents to safely trade-off with the kinematics' variation detected at incoming vehicles, and to timely trigger the appropriate countermeasure packages of AV.
4	*The Electric Bus is an Optimized Trolleybus* Emil TUDOR, Ionuț VASILE and Ion SBURLAN Presenter: Emil TUDOR	**Abstract** - The electric bus with rechargeable battery is a modern vehicle derived from both the classical bus based on an internal combustion engine and from the trolleybus, which has an electric motor powered from the over-head supply network by using a special converter. The approach is that the electric bus is closer to the trolleybus than it appears, and the paper want to analyze the pros and cons of the trolleybuses with the aim to improve the electric bus acceptance.
5	*Potential of a Two Motor Concept for Electric Vehicles with Respect to Its Interaction with the Air Conditioning Unit* Sebastian Sigle and Michael Schier Presenter: Sebastian Sigle	**Abstract** - A common approach to enhance the overall efficiency of an electric driven vehicle is to use a double motor concept. In the hereby presented research project TIOM (Two in one motor) two different electric motors are used for traction and the compressor of the air conditioning (AC) system. The main research questions in the following paper are first which operation scenario fits best for this system and second if the developed operation strategy leads to higher efficiencies. For this purpose a simulation model of the vehicle including the AC circuit was built in Dymola. The model contains a strategy that can select between ten different operation modes for the two motors based on the efficiencies of the motors, the torque requirements, the rotation speed of the wheel and the rotation speed range of the AC compressor. The chosen operation scenarios are four driving cycles: the New European Driving Cycle (NEDC), the Worldwide harmonized Light vehicles Test Cycle (WLTC) and two real driving cycles, a regional cycle and a motorway cycle. The simulation also distinguishes between operation with activated and deactivated AC circuit. As a result the energy consumption in the different scenarios is evaluated and compared to a vehicle with a conventional motor concept with separated motors for the traction and AC circuit.
6	*Powertrain Test Bench System* P.M.Fonte, P. Almeida, R. Luis, R. Pereira and M.Chaves Presenter: Pedro Fonte	**Abstract** - In parallel with major automotive manufacturers, some smaller companies are trying to launch their own electric or hybrid-propulsion models. During the development of these prototypes some tests must be done, namely consumption, autonomy, batteries state-of-charge, gradability, among others. The results of these tests can lead changes in design, motorization or battery packages. This paper presents a powertrain test bench system in order to test electrical vehicles. Regarding the automobile sector, and due to EU ruling, it is intended to enable the test bench to apply the Worldwide Harmonized Light Vehicles Test Cycle. Having a laboratorial test bench that can emulate vehicle dynamics under a specific drive cycle will allow small automotive manufacturers to confirm compliance with the mandatory drive cycles during different stages of their development. Nevertheless, other electric vehicles (EV) like boats or trains, can also be tested since the mathematical models of their dynamics are available.

S3 – Electric Vehicles
15:00 – 16:30
Location: All Electric

Moderators:
1 – Mihai IORDACHE
2 – Mihai NEACŞU

1	*Electro-Thermo-Mechanical Behaviours of Laser Joints for Electric Vehicle Battery Interconnects* Usama F. Shaikh, Abhishek Das, Anup Barai and Iain Masters Presenter: Abhishek Das	**Abstract** - An automotive battery pack used in electric vehicle (EV) comprises several hundred to a few thousand of individual Lithium-ion (Li-ion) cells when cylindrical cells are used to build the battery pack. These cells are connected in series and/or parallel to deliver the required power and capacity to achieve the designed vehicle driving range. This triggers the need for suitable joining methods capable of providing mechanical strength together with the required electrical and thermal performances. A range of joining techniques are currently employed to connect large numbers of cells, and of these, laser welding is estimated to be the one of most efficient methods. Typically, the cylindrical cell casing is made of electrical grade steel which is electrically connected to copper tabs representing the cylindrical cell terminal to tab interconnect within the battery pack assembly. This study focuses on identifying the effect of laser welding process parameters on the mechanical, electrical and thermal responses of the laser welded joints produced using a 150 W Quasi-CW IR laser. Mechanical strength is assessed by evaluating the lap shear strength of the joint whereas the electrical and thermal responses are captured using voltage sensors and a thermal imaging camera respectively. It was observed that mechanical strength of the joint is highly correlated with electrical resistance and corresponding temperature raise at the joint. Furthermore, the optical micrographs reveal the microstructural characteristics of the joint.
2	*A Safety Concept for an Automotive Lithium-based Battery Management System* David Marcos, Jon Perez, Pello Zubizarreta, Maitane Garmendia, Igor Perez de Arenaza, Jon Crego and Jose Antonio Cortajarena Presenter: David Marcos	**Abstract** - This publication describes a safety concept for an automotive domain battery management system in compliance with ISO 26262. First, Lithium-based battery hazards and risks are assessed, associated safety goals are defined to reduce previously identified risks and automotive safety integrity levels are assigned. Then, a safety architecture that meets previous safety goals and requirements is described at system and subsystem level. This safety architecture describes the overall technical safety concept, diagnosis strategy and measures to reduce the probability of systematic and random faults.

3	*Minimization of Battery Pack Imbalance of Electric Vehicles Using Optimized Balancing Parameters* Murat Mustafa Savrun, Tahsin Köroğlu, Erdem Ünal, Burak Onur and Mehmet Uğraş Cuma Presenter: Birand Erdoğan	**Abstract** - Battery, one of the key components of developing electric vehicle (EV) technology, has a great significance in the adoption of EVs. The battery packs consist of several cells connected in series and parallel according to the operating voltage and required capacity. Imbalances between serially connected cells are frequently encountered, although cell balancing between parallel connected cells is not a common concern. Batteries are often equipped with balancing systems to prevent the imbalances, which reduces the available capacity and lifetime of the battery. This paper presents a comparative analysis for passive balancing method by considering Particle Swarm Optimization (PSO) and Genetic Algorithm (GA) to acquire the optimal timing of enabling/disabling the balancing current to minimize imbalance of cells of the EV battery. In order to perform the balancing operation, the cell voltages are continuously monitored by the controller unit. Cells with lower voltages are detected evaluating the average voltage of the cells, balancing resistor switches of the rest are operated. In the optimal timing of enabling/disabling the balancing current, the minimum imbalance is determined as the cost function for PSO and GA. In the proposed study, a battery pack consisting of 16 series cells is modeled by using MATLAB/Simulink. The nominal capacity and voltage of each cell are 108 Ah and 3.7 V, respectively. The performance of the proposed system is validated.
4	*Battery Charging by Using a Multi-Tapped Secondary Coil* Mihai Iordache, Răzvan Asanache, Sorin Deleanu, Marilena Stănculescu, Dragoş Niculae and Lavinia Bobaru Presenter: Mihai Iordache	**Abstract** - This paper presents an inductive coupling system used to recharge the batteries of electric vehicles (EV) as well as the ultra-capacitors used as energy storage elements wirelessly. Although ultra-capacitors can quickly charge, the standard inductive coupled circuits provide maximum power only for specific load impedance. The value of this impedance depends on the geometrical dimensions of the coils, coils configuration, as well as the distance between them. Since an ultra-capacitor in the charging mode is equivalent to an instantaneously increasing impedance, the maximum power supplied to the ultra-capacitor involves a single point inside the charging range, resulting in better optimum charging time. The analysis of the inductive coupling theory reveals that the optimal load impedance can vary by adjusting the secondary coil inductance and the resonant tuning capacitance. The proposal to modify the optimal load impedance dynamically throughout the capacitor charging range consists of a three-tapped secondary coil. Furthermore, this paper aims to design and analyze optimal wireless battery loading systems for electronic devices. The construction of these optimal systems uses an inductive coupling architecture that has a multi-tapped secondary coil (receiver). In this case, there are multiple magnetic couplings between the emitting coil and the receiving coils and even between the receiving coils corresponding to each tap. Consequently, results in a dynamic change of the coils geometries to modify the optimum load impedance and maximize the active power transmitted to the load. A thorough comparison involving performances put face to face the wireless power transfer systems (WPTS) containing only two magnetically coupled coils with those with multi-tapped secondary coils (MTSC). The main conclusion reveals the advantages of inductive architecture with MTSC.

5	*Performance Assessment of an Electric Microcar for Various Urban Driving Conditions* Mehmet Murat Topaç, Levent Bilal, Merve Karaca and Mert Çakır Presenter: Levent Bilal	**Abstract** - Increasing traffic congestion in major cities yields to a growing demand to microcars in global automotive market. Due to their easy-to-use characteristics, microcars are seen as convenient transport vehicles for urban districts. Furthermore, more environment-friendly mobility can be achieved with more frequent utilisation of microcars, due to the lower energy consumption values. In the scope of this work, as a part of the conceptual design step of a newly designed urban electric microcar, a case study on driving performance analysis was summarised. In the first part of the study, some essential design features of the microcar were briefly described. In the second part, a performance assessment study of the vehicle was carried out by using Advanced Vehicle Simulator (ADVISOR®), which is a MATLAB®/Simulink® based simulation software for analysis of the performance and fuel economy of various types of vehicles. Therefore, specific drive cycles which were indicated by the standards were utilised for driving simulations. In the final part, results obtained for the miscellaneous urban driving conditions and selected various types of battery applications were presented and evaluated in multiple aspects.
6	*Design-of-Experiments Analysis of Li-Ion Cell Capacity Fading in High Temperature Automotive Conditions* Richard Stocker, Asim Mumtaz and Neophytos Lophitis Presenter: Richard Stocker	**Abstract** - This paper examines the evolution of performance degradation through capacity fade in Li-ion cells when subjected to 8 months of automotive drive cycles in high temperature conditions. This is done by combining a temperature controlled, highly transient cycling approach with a design-of-experiments matrix varying charge current magnitude and Depth-of-Discharge, two factors known to be influential in ageing rate. The subsequent results are then analyzed using design-of-experiments methodology and trend analysis, comparing the rates of capacity evolution at various points in cell lifetime. What was found is that the cell ageing evolved in 3 main phases dependent on the cycling time duration rather than Ah throughput. In early life, charge current was influential, while in later life depth-of-discharge proved significant. It was also clear, that the factors could not be treated in isolation, with higher order and interaction effects observed. This implies that modeling of cell ageing cannot be uniform across lifetime and must consider the different ageing phases of the cell.

S4 – Policies and strategies in the field of electric mobility
16:45 – 18:15
Location: ShowRoom

Moderators:
1 – Mihai Octavian POPESCU
2 – Lucian TOMA

1	*EMC Normes For Testing Electric And Hybrid Cars* Violeta – Maria Ionescu, Anca-Alexandra Săpunaru, Claudia Laurența Popescu and Mihai Octavian Popescu Presenter: Violeta – Maria Ionescu	**Abstract** - In the past years, electric and hybrid cars have become more and more important due to growing concerns about global pollution. Electric and hybrid vehicles started to grow their number and by 2025 it is estimated that 30 % of all vehicle sales will be electric and hybrid. Developments in the design and improvement of technologies for rechargeable batteries, motors and controllers make again electric vehicles a viable option for transportation. The complexity of vehicle electrical and electronics systems introduces new issues for electromagnetic compatibility (EMC). The rapid development of the automotive industry and the trend towards autonomous machines using advanced driver-assistance systems, make electromagnetic compatibility design and test scenarios to be more sophisticated and rigorous. Vehicle architecture is becoming increasingly complex, including electronic devices that require a reliable function without compromising security or communications infrastructure. With the introduction of wireless communications in the vehicle, there is a need for high performance systems that require high transfer rates and hence higher frequencies, depending on the operating environment. Each of these subsystems must comply with electromagnetic compatibility standards. The paper presents the main categories of electromagnetic demands and immunity problems that arise between major components of the vehicle. In the second part of this article are highlighted the revised electromagnetic compatibility international standards for automotive industry with reference to the phenomena described above. To ensure electromagnetic compatibility of electrical / electronic components and immunity of electric vehicles with the environment, the EMC regulations must be applied.
2	*Study Of Radiated Emissions Produced By An Electric Vehicle In Different Operating Modes* Anca - Alexandra Săpunaru, Violeta – Maria Ionescu, Mihai Octavian Popescu and Claudia Laurența Popescu Presenter: Anca - Alexandra Săpunaru	**Abstract** - Nowadays, the global shift towards living a more eco-friendly life is changing the content of vehicles by means of utilizing more and more electric propulsion systems that use high voltage components with safety aspects that may make automotive electromagnetic compatibility (EMC) more difficult. Vehicles with electric propulsion systems, as well as those that use internal combustion engines (ICE) need to comply with certain EMC rules and not overtake an acceptable level of radiated emissions. Compared to ICE vehicles, electric vehicles (EVs) need recharging of the battery after driving and this simple action may cause EMC issues by producing big levels of radiated emissions that are not acceptable for residential, commercial or light industrial environments. Also, while driving, all vehicles have to be compliant with EMC regulations, so that every electric/electronic system and subsystem inside the vehicle or in the proximity of the vehicle, to function as designed and not be harmful or affect in any way human beings or the environment. This study presents the different operating modes an EV should be tested from EMC point of view to check the generated level of radiated emissions. One of the operating modes is "rechargeable energy storage system (REESS) in charging mode coupled to the power grid".

		Another one is “other than REESS in charging mode coupled to the power grid”, but this operating mode can be split in two: “driving mode” and “ready to drive mode”. By analyzing the results obtained from performing real radiated emissions tests in a semi-anechoic chamber on an EV will show the differences between different operating modes, different location of the charging inlet and as well as different types of charging cables.
3	*Using Statistical Methods and Co-Simulation to Evaluate ADS-Equipped Vehicle Trustworthiness* Khalid HALBA, Edward GRIFFOR, Patrick KAMONGI and Thomas ROTH Presenter: Khalid HALBA	**Abstract** - With the increasing interest in studying Automated Driving System (ADS)-equipped vehicles through simulation, there is a growing need for comprehensive and agile middleware to provide novel Virtual Analysis (VA) functions of ADS-equipped vehicles towards enabling a reliable representation for pre-deployment test. The National Institute of Standards and Technology (NIST) Universal Cyber-physical systems Environment for Federation (UCEF) is such a VA environment. It provides Application Programming Interfaces (APIs) capable of ensuring synchronized interactions across multiple simulation platforms such as LabVIEW, OMNeT++, Ricardo IGNITE, and Internet of Things (IoT) platforms. UCEF can aid engineers and researchers in understanding the impact of different constraints associated with complex cyberphysical systems (CPS). In this work UCEF is used to produce a simulated Operational Domain Design (ODD) for ADSequipped vehicles where control (drive cycle/speed pattern), sensing (obstacle detection, traffic signs and lights), and threats (unusual signals, hacked sources) are represented as UCEF federates to simulate a drive cycle and to feed it to vehicle dynamics simulators (e.g. OpenModelica or Ricardo IGNITE) through the Functional Mock-up Interface (FMI). In this way we can subject the vehicle to a wide range of scenarios, collect data on the resulting interactions, and analyze those interactions using metrics to understand trustworthiness impact. Trustworthiness is defined here as in the NIST Framework for Cyber-Physical Systems, and is comprised of system reliability, resiliency, safety, security, and privacy. The goal of this work is to provide an example of an experimental design strategy using Fractional Factorial Design for statistically assessing the most important safety metrics in ADS-equipped vehicles.
4	*Maximum Power Point Tracking and Power/Voltage Regulation for Inductive Wireless Battery Charging* Mohammed AL-SAADI, Emad A. Hussien and Aurelian CRĂCIUNESCU Presenter: Aurelian CRĂCIUNESCU	**Abstract** - The imperfect coupling (or misalignment) between the inductively coupled coils in an inductive power transfer (IPT) system is a major problem of the wireless battery charging. This problem causes decreasing and fluctuations of the system efficiency and load power (or load voltage). In this paper, a new approach was introduced to deals with such a problem. The proposed approach based on the maximum power point tracking (MPPT) and load power/voltage regulation (PR/VR). The MPPT technology based on the impedance matching (IM), where the tuning capacitances are still varying to keep the resonant frequencies of the coils equal to the inverter switching frequency (fs). The proposed PR/VR was achieved based on the duty cycle control of the inverter; the fuzzy logic controller (FLC) was used to achieve that.

5	*The Feasibility of Electric Vehicles as Taxis in a Canadian Context* Ken Darcovich, Hajo Ribberink, Charles Michelet, Kathleen Lombardi and Mohamed Ghorab Presenter: Ken Darcovich	**Abstract** - This study combined real-world driving data and battery simulations to evaluate electric taxi (eTaxi) feasibility in Canada. On-road data from two gasoline fueled taxis, (1-shift, 55,280 km/year; 2-shift, 108,700 km/year) provided performance targets for simulations of electric vehicles (EVs). A project objective was to assess to what degree an EV could attain these targets over a 6-year period, an expected taxi service life. The on-road taxi data were sparse; measured as average speeds for one minute periods. They were integrated with a second set of on-road driving data from a study with a Tesla Model S 70D. These Tesla data had one second temporal resolution, featuring speeds, temperatures and battery power draws. The on-road taxi data were partitioned into segments, and scaled to data from a corresponding regime from the Tesla tests, producing power draw and driving speed at one second resolution, for the battery simulation. The simulation implemented an equivalent circuit representation of an EV battery, derived from discharge curves of its constituent cells. A capacity fade model developed and validated from literature data allowed investigation of long term vehicle performance. Simulations showed that with overnight recharging only, the 1-shift taxi met 89% of the driving schedule. With mid-shift recharging and as-needed depleted state charging, both types of taxis achieved over 98% of driving targets during the 6-year vehicle life. Per scenario, after six years, the 1-shift taxi had 67-75% of the original battery capacity, while the 2-shift had 44-49%. Battery degradation mainly depended on total driving distance and was less impacted by charging rate. These initial forecasts are part of a broader project that also indicates favorable economics, leading to a forthcoming second phase of research involving on-road tests with EVs partnered with Canadian taxi operators.
6	*New Mobile Charging Station for Urban and Resort Areas* Daniel FODOREAN, Filip CIRLEA, Maria Simona RABOACA and Constantin FILOTE Presenter: Daniel FODOREAN	**Abstract** - The paper presents a new mobile charging station, capable to use the energy from the ac grid, as well as from the one from the dc grid (used in the electrified transportation), to store the energy on a hybrid storage source (battery, fuel cell and ultracapacitor) and to deliver it to electric vehicles. Such a mobile charging station is to be used within the cities and resort areas, where (especially) people need independent mobility within a cleaner environment. The proposed mobile charging station architecture is depicted, as well as its operation through simulations.

S5 – Electric Vehicles
16:45 – 18:15
Location: All Electric

Moderators:
1 – Mihai MARICARU
2 – Grigore DANCIU

1	*Sensorless Control of Multi-Motors PMSM using Back-EMF Sliding Mode Observer* Marcel NICOLA, Claudiu-Ionel NICOLA and Adrian VINTILĂ Presenter: Marcel NICOLA	**Abstract** - This article presents a sensorless control system based on back-EMF (back electromotive force) sliding mode observer for control of rigid coupling of PMSM multi-motors. The back-EMF eα and eβ are provided by a sliding mode observer in order to estimate the rotor speed and position. The main advantage of the sensorless control consists in eliminating the speed transducers thus contributing to the increased reliability of the entire system. The control structure presented is cascaded, following the FOC (Field Oriented Control) principles, where the inner current loop has the reference Id set to be equal to zero, and the Iq reference is set by the PI-type speed controller in the outer loop. Considering that the load torque distributed to the two motors can be balanced or unbalanced, the main task of the multi-motor PMSM sensorless control system is to maintain the same speed of the slave system and the master system and that both systems match the required speed profile. Real time implementation of the multi-motor PMSM sensorless control system is recommended by the good results obtained from numerical simulations.
2	*Novel Methods, Schemes and Techniques of Synchronous Modulation for Control of Transport Power Conversion Systems: An Overview* Valentin Oleschuk and Vladimir Ermuratskii Presenter: Valentin Oleschuk	**Abstract** - This manuscript presents short survey of novel methods and algorithms of alternative synchronous spacevector modulation elaborated for scalar control of power converters and induction motor drives for transport systems. It includes both description of peculiarities of this new modulation strategy, and examples of its development, modification, and dissemination for basic topologies of threephase, five-phase, and six-phase systems (based on two-, threeand four modulated inverters) for electrified transport. These methods and techniques of synchronous pulsewidth modulation (PWM) allow providing continuous synchronization and waveform symmetry of the phase and line voltages of ac drives, with minimization of undesirable subharmonics in spectra of voltage and current, and also with minimization of undesirable common-mode voltage in traction drive systems.
3	*All-Wheel Drive Electric Vehicle Performance Optimization: From Modelling to Subjective Evaluation on a Static Simulator* Alessandro Ferraris, Henrique de Carvalho Pinheiro, Edoardo Galanzino, Andrea Giancarlo Airale and Massimiliana Carello Presenter: Henrique de Carvalho Pinheiro	**Abstract** - Powertrain electrification is undoubtedly recognized as a major trend in the automotive industry. The elimination of the internal combustion engine opens to different vehicle's architecture designs, to improve habitability and reduce cost. The paper focus on an All-Wheel-Drive Full Electric high-performance vehicle equipped with wheel-hub motors, a layout that offers a significant potential in controlling each wheel individually. The objective is to develop a control algorithm capable of handling wheels torques independently to enhance vehicle's dynamic, keeping into consideration the model's energy performance. The control algorithm is entirely developed in Matlab-Simulink and implemented in the vehicle dynamic model, in a co-simulation environment with VICarRealTime software. Offline simulations are performed to tune the controllers and evaluate their impact on vehicle dynamics and energy efficiency. Finally, the model is tested in a real static simulator to be validated and to have a subjective interpretation of the dynamic behavior of the vehicle.

		Handling improvements are evaluated through a racetrack lap time performed by the VI-Grade virtual driver. Energy efficiency protocols instead will be assessed by monitoring the battery State of Charge variation and their impact on vehicle's behavior will be analyzed on the static simulator. The results point out to an improvement in the lap time thanks to the more agile and less understeering vehicle. Energy optimization algorithms and regenerative braking displays a promising energy reduction without compromising vehicle dynamics. The same racetrack from the offline simulations is used to test the model on the static simulator. Torque vectoring impact on driver's feeling is found to be noticeable and helpful in improving vehicle's response during cornering while energy optimization protocols are not affecting the dynamic performance.
4	*The modeling and simulation of an Electric Vehicle based on Simcenter Amesim platform* Cristi Irimia, Mihail Grovu, Gabriel-Mihai Sirbu, Adrian Birtas, Calin Husar and Matthieu Ponchant Presenter: Calin Husar	**Abstract** - In this paper, two main objectives were pursued: validate a battery model through measured data and simulate an electric vehicle using the confirmed battery model. The experimental results obtained in the test of the Renault ZOE electric car have been used. The test consisted in achieving a required speed profile, being navigated 83 km in a 6267 seconds driving cycle. We considered two battery models: quasi-static and dynamic. The electric vehicle model is powered by the validated-by-measurements battery dynamic model. Considering the speed profile as input for both simulations, battery and vehicle, the simulation results are compared with the test results. Appropriate models have been developed to ensure a good correlation with experimental results. This study represents a foundation for future researches about the development of the virtual car model using converter and more complex electric motor models.
5	*The Influence of Permanent Magnets' Position in the Double Stator Vernier Machine's Performances* Darius Vasile Moldovan, Florin Nicolae Jurca, Claudia Steluța Marțiș, Paul Minciunescu and Bogdan Vărăticeanu Presenter: Darius Vasile Moldovan	**Abstract** - Permanent magnet Vernier machines (PMVM) are getting more and more attention due to the propulsion of light electric vehicles (EVs) provided by high torque at low speed. The purpose of this paper is to compare and analyze the optimal structure in order to develop a new type of dual stator machine with high performances due to the stator and the rotor configuration. For the presented structures used as a motor were examined the magnetization of the cores, the flux line distribution, the magnetic flux density in the air gaps, the variation of the electromagnetic torque in time and the variation of currents phase in time. Because of the in wheel condition, the windings of the stator were kept inside. The structure with the best performances was analyzed as a generator.
6	*Performance Analysis of Outer Rotor Synchronous Reluctance Machine with Different Number and Form of Flux Barriers Per Pole* Răzvan Alexandru Inţe, Florin Nicolae Jurca, Bogdan Vărăticeanu, Paul Minciunescu and Claudia Marţiş Presenter: Răzvan Alexandru Inţe	**Abstract** - This paper presents the electromagnetic design of a low power outer rotor synchronous reluctance machine. It is well known that the form and the number of flux barriers influence the electrical (power factor, saliency ratio) and mechanical (torque, torque ripple) performances of the synchronous reluctance machine. For this study has been investigated the influence of different number of barriers on different rotor pole. Also, the form of the flux barriers will be change for half of the rotor poles. To characterize the outer rotor synchronous reluctance machine magneto-static and transient-magnetic simulation are compute.

Friday – 04.10.2019

S6 – Electric Vehicles
11:45 – 13:15
Location: Icpe Club

Moderators:
1 – Mihaela ALBU
2 – Laurenţiu DUMITRAN

1	*Mobility Turnaround, Air Pollution Control and Secure the Budget - Electric Mobility in the Urban Area of Tension* Janine Mielzarek Presenter: Janine Mielzarek	**Abstract** - This paper describes the broad commitment of "Stadtwerke Offenbach Unternehmensgrupp" in the field of electric mobility. It also deals with the current challenges posed by the traffic turnaround, inner-city air pollution and political guidelines. The individual projects include the electrification of company fleets, the electrification of the entire bus fleet of the local public transport company in Offenbach, the addition of electric car and pedelec sharing to local public transport and the adequate supply of charging infrastructure in public urban areas.
2	*Participation of the Electric Vehicles in the Balancing Market* Adrian-Toni RADU, Mircea EREMIA and Lucian TOMA Presenter: Adrian Toni Radu	**Abstract** - In the context of the massive increase in share of generation from renewable energy sources (RES), the network operators face increasing challenges related to the reliable and stable operation of the power system, at the same time with ensuring the balancing between generation and load. Electric Vehicles (EVs) can support RES integration by appropriate design of the electricity markets, allowing their owner of the aggregators to use their energy storage capability to balance the load. In this paper, we propose an optimization model aiming to determine the available power reserved that allow the EVs to participate in the balancing market. The aim is also to maximize the expected revenue of the aggregator and minimize the imbalances between the forecasted and the real load.
3	*Identification and Evaluation of Electric and Hybrid Vehicles Propulsion Systems* Cristina-Adina Bilațiu, Sorin Iulian Cosman, Radu-Andrei Marțiș, Claudia Steluța Marțiș and Silvan Morariu Presenter: Cristina-Adina Bilațiu	**Abstract** - This paper deals with identification and evaluation of electric and hybrid propulsion variants for vehicles. The first part of the study identifies and studies the existing variants of propulsion systems for electric and hybrid vehicles. This involves analyzing the existing systems on the market in order to find out as much relevant information about the characteristics and particularities of each of them. Once these analyzes are complete, the main requirements to be met by the propulsion system are determined. The next step involves a comparative study between the systems already analyzed in order to evaluate the performance of different system configurations. This stage aims at choosing a propulsion system that can meet all the requirements of the vehicle. The final purpose is to identify the optimal topology of the propulsion system components, as the electric machine, the power converter or the control module.

4	*Battery Cells Characterization for Subsequent Operation in Battery Models used in Mobile Charging Station Designing* Rares Catalin NACU and Daniel FODOREAN Presenter: Rares Catalin NACU	**Abstract** - This paper deals with a battery cell characterization, having a lithium iron phosphate (LiFeSO4) chemistry, based on first order electrical equivalent circuit (EEC), within the charging station application. More precise, the reliability of the method is taken into account in the context of a new mobile charging station development. The analysis is numerically and experimentally employed. The results between the simulation and real battery measurements are compared based on international standards and regulations which refer to Electrical Vehicle (EV) charging stations. The Li-Ion cell characterization model and simulation has been developed in Matlab/Simulink software and a dSpace/MicroLabBox realtime board for the measurements. A very good agreement was found between the simulated and tests obtained results.
5	*Electric Drive Solution for Short Distance Passenger Railway Vehicles on Non-Electrified or Mixed Lines* Marius Alin Gheți, Gabriel Popa and Sorin Arsene Presenter: Marius Alin Gheți	**Abstract** - The goal of this article is to find alternative solutions for diesel railway vehicles. An efficient and sustainable solution is to use batteries as an electric power source. In order to determine the required energy and therefore the capacity of these batteries, it is necessary to carry out a traction study to determine the optimal energy consumption as well as the maximum power recovered by the electric brake using the electric traction motors. The proposed solution involves charging batteries at the route terminus. The study in this paper is applied on a tram route in Bucharest where is considering that the trams travel on a non-electrified section which represents a third of the entire route. Although the study is carried out for a tram, the solution can be extended for a DMU (diesel multiple unit), converting it to a BEMU (battery electric multiple unit), intended to be used for passenger trains running on short distances non-electrified lines, where the costs of introducing power systems through the catenary are not financially justified. In general, the proposed solution may be used on tourist lines, city lines that goes through the historical part of cities, or in metropolitan areas around major cities.
6	*Electric Powered Miniature Vehicle for Multi-Agent Network Testbed* Gorgoteanu Damian and Molder Cristian Presenter: Gorgoteanu Damian	**Abstract** - Swarm systems is a new trend in autonomy and more platforms are currently tested for various application. Multi-agent autonomy and self-organization is a target for most such systems, either ground-, air- or sea-based. This article presents the design of a novel ground-based electric vehicle used as a technology demonstrator for autonomous multi-drone systems. The vehicle is equipped with differential steering, battery management circuits, optical and vector flow encoders, omni-vision and wireless transceivers. The vehicle is based on an 8-bit microcontroller (MCU) which is remotely controlled via a computer. The MCU is also responsible with the sensor acquisition, telemetry and message display for local debugging. The final goal of the system is to develop a testbed for path planning and coordination of agents in a swarm system based on simple cooperative and competitive algorithms. The electric vehicle is tested indoor and results are critically analyzed in order to efficiently evaluate the precision of the path planning system as a whole.

Poster Session

Location: Main Hall

1	*Modelisation of Hydrogen Production using Photovoltaic Electrolysis* HAJI Zakaria, MOUNIR Hamid and EL MARJANI Abdellatif Presenter: HAJI Zakaria	**Abstract** - The Electric Vehicle (EV) technology addresses the issue of the reduction of greenhouse gas emissions (GHG). Normally, EVs are recharged with electricity generated from conventional energy sources. For full clean mobility and to have zero emissions and favorable environmental impact, it is better to charge the vehicles from Renewable Energies Systems (RESs). Using RESs for producing hydrogen is a main method to store RESs. This option is required to integrate energy storage system based on hydrogen storage. Hydrogen can be produced by using solar photovoltaic energy for the electrolysis of water. This paper focuses on the Proton Exchange Membrane Electrolyzer (PEME) and covers a board array of subjects linked to this electrolyzer. Gives a control oriented modeling of the PEME, as well as the auxiliary system for the hydrogen production process. In fact, PEME is the most suitable for transforming electricity from RESs. In this context, the present paper describes the essential steps of hydrogen production from the photovoltaic solar energy through PEME, in order to describe the various phenomena related to this technology.
2	*Numerical Analysis Validation Through Experiments of an Elemental PEM Fuel Cell used in the Electric Vehicles* Ioana Ionică, Mircea Modreanu and Cristian Boboc Presenter: Ioana Ionică	**Abstract** - In an electric vehicle (EV), several types of sources for the electric power supply are present, one of which is the fuel cell. Its efficiency is quite high when comparing it with other methods of conversion. In practice, the isothermal efficiency of reactions that takes place in the fuel cell is about 50-60%. Therefore, experimental tests were performed in order to better understand the phenomena that occur in the fuel cell. This paper presents the experimental results on H2 production through an electrolysis process and then its flow into a fuel cell in order to eventually generate electric power. Through this experiment is validated the numerical analysis that was presented in a previous paper at EV2017. The electrical parameters (voltage, current and power) are monitored. This program allows to directly observe the PEM cell operation in order to see how the H2 is produced from water to be used to create electricity. This program records and evaluates the voltage, current and power values of PEM cells.
3	*Finite Element Simulation of Welded Rectangular Profiles for Electric Vehicles* Imane Amarir, Hamid Mounir, Abdellatif El Marjani, Kaoutar Daoudi and Zakaria Haji Presenter: Imane Amarir	**Abstract** - Recently, the fatigue phenomenon of welded structure is more complicated in different industries, especially in the case of electric vehicles (EVs). In fact, there are various parameters that can affect this phenomenon as: the detail of geometry, the nature of material, the quality of the welding process and the environment. In this paper, a three dimensional of finite element simulation was built to estimate the fatigue life of a structure based on welded rectangular profiles for transportation utilization. The results indicated the life cycle analysis of our structure, the location of the critical areas at the vicinity of the welded joint and, the loading history impact on life design which is represented in form of a curve showing that the loading variations are reduced with an increase of durability.

4	*Comparison of Spiral and Square Coil Configurations in Wireless Power Transfer System for Contactless Battery Charging* Mohammed AL-SAADI, Stanimir VALTCHEV, Luis ROMBA, José Gonçalves and Aurelian CRĂCIUNESCU Presenter: Aurelian CRĂCIUNESCU	**Abstract** - In the inductive contactless battery charging, the power transfer capability and efficiency are mainly depending on the coupling coefficient (k) between the inductively coupled coils. In this work, the spiral and square coil configurations were experimentally made from litz wire as well as another spiral copper coil. This study investigates the frequency characteristics of these coil configurations in order to analyze the frequency characteristics of the self-inductance and equivalent series resistance of each coil; as well as we measured coefficient k under different conditions based on the air-gap variation between the inductively coupled coils and the misalignment between them. Furthermore, we examined the interoperability between the spiral and square coils configurations. It has been found that the litz spiral coil achieved slightly higher selfinductance with compare to litz square coil and spiral copper coil. Likewise, the square litz coil has slightly high equivalent series resistance with compare to other coils. On the other hand, the copper spiral coil has achieved better k than the other coupling interfaces of the litz wire coils.
5	*An Analysis of Hybrid/Electric Vehicle Monitoring Systems and Parameters* Alexandru Drosu, George Suciu, Andrei Scheianu and Ioana Petre Presenter: George Suciu	**Abstract** - Electric or hybrid vehicles are becoming increasingly popular these days due to their friendly environmental approach, low or almost nonexistent fuel consumption, low taxes or governmental buying bonus. However, very congested metropolitan areas may affect the electric/hybrid vehicles performance, reliability and battery health due to excessive wear, high waiting times and low-speed movement. Frequently monitoring the hybrid/electric vehicles parameters may be needed to prevent electrical or electronic malfunctions, since this kind of issues may be expensive to solve. In this paper, we explore the ways these types of vehicles can be electronically monitored and investigate the influence of certain factors (environmental, traffic-related) over the vehicle's performance, reliability and battery wear/health. An overview of the equipment, software and working principles of the testing devices is presented. Also, we propose a low-cost electric/hybrid vehicle monitoring system based on the acquired knowledge. A 2018 Mitsubishi Outlander PHEV was used for experimentations, parameter monitoring and all the system were tested using this plug-in vehicle.
6	*Low Emission Infrastructure for Powered EVs* Badea Nicolae and Badea George Vlad Presenter: Badea Nicolae	**Abstract** - One of the challenges facing the increased usage of EVs is the possibility to add energy to them, be it in the form of gas (hydrogen) or electricity. The standard is set by classic petrol and diesel fueling system. Motor vehicles powered by hydrogen have currently quite a low market penetration. However, hydrogen refueling infrastructure is starting to build-up in order to make larger-scale hydrogenpowered motor vehicle deployment possible. The European Directive on the deployment of alternative fuels infrastructure requires states to create and submit national policy frameworks in order to develop the widespread use of alternative fuels and the required infrastructure, charging points for Electric Vehicles (EVs) and hydrogen refueling points. In present the fueling hydrogen stations for FCEV is separate of recharging points for EVs as BEV and PHEV. The paper deals the dual electricity - hydrogen charge station in interaction with smart grid and renewable energy sources all controlled by Energy Management System (EMS). The refueling stations have options for all-EVs: as BEV and PHEV or FCEVs. The EMS has the ability to control the loading and unloading of a hydrogen storage system and electricity production by fuel cell, managing the energy flow in order to maintain grid stability and could be solved if charging is used on times of low electricity demand and/or high supply.

		The principal elements of the charging station are the EMS and controller, photovoltaic setting with Maximum Power Point Tracking (MPPT), energy storage unit in DC link, two DC/DC isolated for elecrolyzer and fuel cell, hydrogen storage and bidirectional inverter to grid connection. Because the refueling stations for FCEV and the recharging points for EVs are regulated by the international standards the novelty of this paper is use and connection of the elecrolyzer and the fuel cells of types Proton Exchange Membrane (PEM) for configuration of the EMS and controller.
7	*An Energy Saving Strategy of Torque and Battery Distribution for an Electric Vehicle Driven by Multiple Traction Motors* Yi-Hsiang Tseng and Yee-Pien Yang Presenter: Yee-Pien Yang	**Abstract** - This paper proposes an energy saving strategy of torque and battery distribution (TBD) for an electric vehicle (EV). This EV is driven by three traction motors: one 15 kW motor drives front wheels indirectly through reduction gears, and two 7 kW in-wheel motors are directly installed inside both rear wheels. Each traction motor has independent motor drive and battery pack. Once the driver accelerates the vehicle, the best torque distribution among the three motors is determined by Particle Swarm Optimization (PSO) theory for minimizing energy consumption according to the torque-speed-efficiency (TNE) maps of the three traction motors. At the same time, the States of Charge (SOC) of the three battery packs are kept in balance to avoid unexpected battery depletion and to improve the driving range of the EV. Compared with the energy saving strategy by PSO without charge balancing in simulations, the proposed TBD strategy improved the driving range by 27.9% for the straight-line New European Driving Cycle (NEDC) and 7.67% for the cornering NEDC along a circle of 100-m radius, while the batteries' SOC gaps were maintained within a prescribed limit. At this, all the battery energy can be effectively used for extending driving range with an energy consumption efficiency of 99.5%. The proposed TBD is promising for energy economy of the EVs with multiple traction motors and batteries.
8	*PMSM Rotor Topologies for Automotive HVAC System* Iulia Văscan, Florin Pop Pigleșan, Claudia Marțiș and Ion Bârsan Presenter: Iulia Văscan	**Abstract** - This paper analyzes in a comparative manner four permanent magnet synchronous machines (PMSM) with different rotor topologies for a heating, ventilation, and air conditioning (HVAC) system. PMSM has the advantages of small size, light weight, simple structure, reliable operation, high power factor, easy heat dissipation and easy maintenance. The rotor topologies including interior permanent magnets (IPM), surface permanent magnets (SPM), buried (spoke) permanent magnets and V-shape permanent magnets (VPM). The configuration of the PMSM is 18 slots and 6 poles, distributed winding. The considered application asks that the outer diameter and stack length of the machine stator, as well as the permanent magnets volume to be constant. The rotor topology is modified to investigate, via a two-dimensional (2D) transient finite element analysis (FEA), the electromagnetic performance (torque and cogging torque) and the efficiency of each topology.

9	*Evaluation of Electric Power Losses of an Induction Motor Driving a Compact Electric Vehicle at Change of Parameters and Loads* Svilen Rachev, Dimo Stefanov, Lyubomir Dimitrov and Dimitrina Koeva Presenter: Svilen Rachev	**Abstract** - Nowadays, the search for ways to increase the efficiency of electric vehicles is particularly relevant. However, ultimately, the purpose of electric mobility is, besides ecology, to be as cheap as possible. As with conventional cars, the cost is directly related to power. Everything in an electric car is subject to maximum energy savings. A condition for the development of electric vehicles is the use of suitably designed electric motors as a driving component of the electromechanical system. At present, in electric vehicles induction motors are mainly used for better efficiency and due to their known advantages. The motor, subject of research, is suitable for fast and easy vehicle conversions by replacing the engine of many compact front wheel drive vehicles. Paper deals with evaluation of the combined influence of changing the equivalent circuit parameters and the total moment of inertia on the electric power losses in a compact electric car drive in the dynamic modes arisen. Simulations have been performed using an appropriate mathematical model of electromechanical system. Results in tabular and graphical form have been obtained. Relevant conclusions have been made. Except for analysis, the developed model can also be used to finding a solution of the opposite task – development of electric motors and control systems with parameters, guaranteeing ongoing processes at user-defined requirements.
10	*Motor Variants for Light EV Optimized based on Hybrid Evolutionary Algorithm* Daniel FODOREAN and Lhassane IDOUMGHAR Presenter: Daniel FODOREAN	**Abstract** - The paper depicts an design approach for the proposition of a new propulsion unit for a light electric vehicle (EV). For the given main data of the application, four motor variants are studied, numerically evaluated based on finite element method (FEM) and compared in terms of performances. The best suited variant is finally optimized based on evolutionary algorithm and numerically validated with respect to the application demands.
11	*Optimizing parallel connection of Medium Frequency inverters for EV Wireless Charging* Răzvan Prejbeanu, Andrei Marinescu, Dan Octavian Neagu and Alexandru Radu Presenter: Andrei Marinescu	**Abstract** - Wireless battery charging has recognized advantages over conductive charging and is the preferred solution for driverless electric vehicles of the near future. At present, the powers transferred through the two systems are standardized in the power series 3.7 - 7.4 - 11 - 22 kW. From the justified desire that the duration of the loading process be comparable to the duration of the petrol supply of conventional vehicles with internal combustion engines, fast charging systems have been developed that can transmit power that reaches hundreds of kW. The paper analyzes the possibility of economically realizing a high power wireless charging by mounting in parallel "n" identical inverters modules, controlled by a robust and adaptive control loop. The conditions for achieving a smart adaptive micro-grid are met. A new topology for power circuits and a control structure for micro-grid-connected inverters with non-shock-free operation and balanced distribution of power and current between inverters is proposed.
12	*Comparative Analysis between Gas Turbine and Electric Combined Propulsion* Filip Niculescu, Mirela Letitia Vasile, Cristian Nechifor and Adrian Stoicescu Presenter: Filip Niculescu	**Abstract** - The paper analyzes the advantages and disadvantages of propulsion with gas turbine engines or in combination with electric motors. Gas turbine engines are used in marine propulsion for certain advantages such as high power generated at low weight, low maintenance and low nitrogen oxides emissions. Fuel consumption is higher than diesel propulsion. To reduce consumption, the gas turbine combines with a steam turbine which, with an electric generator, produces electricity for the needs of the ship. The analysis highlights the modern trend of using combined propulsion systems in shipping.

13	*Traffic Status Evaluations on an Urban Street Section* Borș Adriana Mariana Presenter: Borș Adriana Mariana	**Abstract** - The paper shows a method of estimating as accurately as possible the state of traffic on an urban street section delimited by applying a multicriterial calculation model for improving the estimation of the level of air quality pollution. The algorithm can be applied to a linear road section for which the travel time is minimal, data recorded for a number of cars stationed at the traffic light during the traffic light cycle of approximately 1 minute (constant value), over a period of 30 days, on sets of values at 30 min ranges for 24/24 h. The method develops a linear algorithm that can be adjusted depending on traffic flow status (crowded or fluidized) using the Kernel normalization function, which can combine both crowded and fluidized traffic (free car flow). The algorithm facilitates the tracking and recording of data from multiple sources to simulate a more accurate local traffic situation, which in turn allows for better estimates of travel time and vehicle emissions on the linear section delimitate of urban street. For optimization of the estimation results, the calculation includes the parameters of the momentary traffic status. Thus, the determination of traffic flow status leads to the setting of speed regime, accuracy of emissions estimation and fuel consumption. These aspects are support in taking operational management decisions to reduce traffic congestion and the negative impact on the environment.
14	*Voltage Fault Diagnosis of Power Batteries based on Boxplots and Gini Impurity for Electric Vehicles* Hao Yin, Zhenpo Wang, Peng Liu, Zhaosheng Zhang and Yang Li Presenter: Hao Yin	**Abstract** - Power battery is a critical factor affecting the safety of electric vehicles (EVs). Fault diagnosis and prediction of power batteries are of great significance to ensure the safety of EVs. This paper proposes a voltage fault diagnosis model based on boxplots and Gini impurity. Considering cells voltages are not normal distribution at any time, we use the boxplots to analyze the monitoring voltage data and identify the abnormal cells with coarse granularity. To quantify the abnormality of each cell, the anomaly distance is defined based on boxplots. Considering each time has different degrees of influence on the final result of each cell, we use the Gini impurity weighting method to measure the contribution rate of each time. By this means the goal of further locating the faulty cells accurately can be achieved. And then we can easily identify those faulty cells by utilizing the Z-score method. Different from other previous researches, the validation and contrast experiments in this paper are carried out by using the actual vehicle operation data of the National Monitoring and Management Center for NEVs in Beijing. The results of experiments clearly show that the proposed model has high diagnostic efficiency relatively and the faulty cells in the battery system can be located accurately.
15	*Adaptive Sensorless Control of PMSM using Back-EMF Sliding Mode Observer and Fuzzy Logic* Marcel NICOLA, Claudiu-Ionel NICOLA and Marian DUȚĂ Presenter: Marcel NICOLA	**Abstract** - This article presents a sensorless control system of PMSM (Permanent Magnet Synchronous Motors) using aback-EMF (back electromotive force) sliding mode observer and a main and correction fuzzy logic controllers to adapt continuously the adjustment parameters Kp and Ki of the speed controller part of the FOC (Field Oriented Control) strategy and achieving superior adjustment performance without overshooting and reduced rising and settling time. In order to achieve superior performance, a second fuzzy controller is proposed which, besides the error and the error derivate of the rotor speed as inputs will also take into account the load torque (an estimate of it) to adjust the adjustment parameter Kp differently depending on the load torque size, but also on the dynamic or stationary regime that occurs during the required speed profile tracking.

16	*Improving the Range of Electric Vehicles* Parth Kadav and Zachary D. Asher Presenter: Parth Kadav	**Abstract** - Electric Vehicles (EVs) are efficient, cheap and emit less than Internal Combustion Engine (ICE) that are currently used. However, they lack giving out a good range because current charging infrastructure doesn't allow them to do so. Many people consider EVs to be a gimmick and not a real mode of daily commute because of their poor range. To overcome these problems, solutions which can improve their range significantly, are discussed. A solution to improving the range will not be solved through the use of any one technique, but through an integration of different engineering practices.
17	*Hybrid Propulsion Train with Energy Storage in Metal Hydrides* Alexandru Stanescu, Nicolae Mocioi and Andrei Dimitrescu Presenter: Alexandru Stanescu	**Abstract** - Paper aims to present a variant of hybrid propulsion train with energy storage in metal hydrides. Train propulsion is carried out by eight permanent magnet synchronous electric motors (PMSMs) mounted on bogies. The electric power required to drive these motors is provided by the existing electric railway network or the electric generator set fitted within the train, which is remarkable as it allows it to be used without restriction even in non-electrified railway network zones. The novelty of this paper consists in the fact that the diesel engine of the generator runs on hydrogen stored in metal hydride tanks on the gasket.
18	*LCA Indicators in Electric Vehicles Environmental Impact Assessment* Adriana Tintelecan, Anca Constantinescu - Dobra and Claudia Marțiș Presenter: Adriana Tintelecan	**Abstract** - Life Cycle Assessment is a method through which the environmental impacts of a product or system is analyzed, during its life cycle, in terms of sustainability. The transport sector is one of the largest contributors to climate change, pollution and noise emissions. E-mobility and electric vehicles offer a major opportunity to solve the external negative effects associated with internal combustion engines. Therefore, the development of electric vehicle technology plays an important role in sustainable transport. In this study the main aspects which must be taken into account to accomplish a more accurate analysis of the environmental impact of electrical vehicles are discussed. Thus, the goal of this paper is setting up the indicators in order to deploy an LCA analysis of a battery electric vehicle. Dividing the electric vehicle into subsystems, an analysis was started on permanent magnets in the electric motor.
19	*Genetic Algorithm Parameters Effect on the Gear Drive System* Kaoutar Daoudi, El Mostapha Boudi, Imane Amarir and Yassine Amadane Presenter: Kaoutar Daoudi	**Abstract** - Using conventional optimization techniques is not a good solution for problem optimization. In this study, the non-traditional technique called Genetic Algorithm (GA) has been used in the design optimization of the gear drive system. It aimed to investigate the effects of the GA parameters on the performance of the optimum design of the gearbox by obtaining a minimal weight. The most significant of these parameters were population size, selection type, crossover and mutation operators, and penalty function. The GA has been applied to the gearbox with two-stage, one was an epicyclical gear train with spur gears and the second one was a simple gear train, with respect of bending strength constraint, contact stress constraint, balance constraints for the planetary gear train and some dimension constraints for gears. The obtained results indicate that GA can be used reliably in machine element design problems and each parameter of them have been a great influence on the final solution.

20	*4WD automatic robot for feeding animals from a shelter* Filofteia Valentina Voinea, Ioan Dragoş Deaconu, Aurel Ionuţ Chirilă, Andreea Mădălina Lupaşcu and Valentin Năvrăpescu Presenter: Filofteia Valentina Voinea	**Abstract** - In this paper is described a four-wheeled autonomous robot vehicle that has as main application the feed of the animals (domestic or savage) found within an animal shelter, without the need for human presence. There are described both the hardware design of the robot (microcontroller, sensors, prime mover) and the artificial intelligence behind the robot behavior.
21	*Availability Bids Enabling Participation of Electric Vehicles in the Wholesale Markets* Izabela Zoltowska and Jeremy Lin Presenter: Izabela Zoltowska	**Abstract** - We propose the participation model for Electric Vehicles (EVs) aggregators in the wholesale markets, that is based on rules originally available for thermal generators only, whose characteristics have been internalized with dedicated bids via constraints typical of unit commitment-based market clearing mechanisms. The key idea is to internalize technological constraints of EVs (namely capacity of batteries), while preserving the flexibility exposed in their convenient charging availability. EVs can express their economic preferences regarding additionally purchased energy by specifying the desired state of charge, and bid prices. We propose a rather simple modification in bid/offer-based optimal power flow (OPF-DC) model, and show in case study the benefits for EVs and efficiency for the system.
22	*Optimisation Analysis of the Hybrid Vehicles Powertrain* Grigore Danciu and Alexandru Ancuta Presenter: Grigore Danciu	**Abstract** - The hybrid electric vehicles are a special category of vehicles, developed for optimization of internal combustion engines. They represent a temporary solution in the way to fully electrification of vehicles. The purpose of this paper is to clarify the functioning of hybrid vehicles and emphasize their advantages over classical internal combustion engine vehicles. For this reason, the paper explains the drivetrain optimization starting from the brake specific consumption map diagram.

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EV2019 Reviewers - Short Professional Biography

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