IEEE

UNIVERSITÀ DI PARMA

2025 IEEE INTERNATIONAL WORKSHOP ON

Metrology for Automotive

MetroAutomotive Parma 2025

PARMA, ITALY, JUNE 25-27, 2025

FINAL PROGRAM

ATHENA
BUSINESS AND TECHNOLOGY CONSULTING

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Welcome Message from the General Chairs

On behalf of the Organizing Committee, we warmly welcome you to the **2025 IEEE International Workshop on Metrology for Automotive** (MetroAutomotive). This year the 5th edition of the Workshop will be held at Centro Santa Elisabetta, a renewed rural building inside the Science and Technology CAMPUS Area of the University of Parma.

After the first edition launched in 2021, and successive editions held in Modena and Bologna, the Workshop is held for the first time in Parma aiming to collect the interest of the automotive community around the role of instrumentation, sensing, and measurement technologies in this important field.

The fundamental goal of the Workshop is to bring together Researchers from universities, research centers, and industry, to stimulate the exchange of the latest scientific and technological research findings, and to foster discussions free of barriers of any kind in a common forum where innovative ideas can be exchanged to inspire further developments in the fascinating field of Automotive.

The 2025 IEEE MetroAutomotive Workshop is scheduled over three days, aiming to cover all the main fields of Metrology for Automotive, with the keynotes providing a focus on the current and future trends as seen by some major players in the Automotive scenario. The Technical Program includes 5 keynotes, and 10 technical sessions. We would like to thank the Organizers of the technical special sessions for their cooperation and support in organizing the Workshop.

The Keynotes will be held by recognized experts from the industry in the field of Metrology for Automotive, as follows:

- Tomás Pedraza, Chassis & Powertrain NVH Performance Manager, Ferrari, Italy: *Use of Blocked Forces Measurement Methodology to Enhance E-Axle NVH Forecast*
- Luca Bergianti, DALLARA: *A hybrid approach to tires development for high performance cars: a proper balance of virtual modeling and track validation*
- Simone Di Piazza, Ducati Motor Holding, Italy: *Motorcycles' future challenges: Ducati strategy*
- Aldo Caraceto, from Mathworks, Italy: *Modeling and Control Techniques in Hybrid-Electric Vehicle Subsystems*
- Mattia Violi and Mattia Maffioletti, HPE, Italy: *Artificial Intelligence Supporting End-of-Line Decision-Making: Evolution of Testing Equipment from Measurement Systems to Test Benches*

In addition, on the first day a special event will be held at *DALLARA S.p.a* in Varano de' Melegari, Parma. DALLARA is the largest multi-national Italian race car manufacturer, founded in 1972 by its current President, Giampaolo Dallara. Here after two technical sessions, an immersive technical visit will be offered to the participants, for a unique look at DALLARA 's cutting-edge facilities, including their professional driving simulator. Moreover, in the framework of the

MetroAutomotive workshop, the IEEE Power Electronics Society (PELS) will organize, an Open tutorial on Measurement Practices and Challenges in Electrical Machines and Drives for Transport Applications supported by PELS TC3: Electrical Machines, Drives and Automation.

As in the previous editions, the 2025 IEEE MetroAutomotive also benefits from a Panel Session organized by the IEEE Women in Engineering (WIE) Italy Section, to foster discussion about the impact of gender diversity in the design methodologies, technologies, and approaches pursued in the Automotive Sector.

Keynotes, as well as technical presentations, will be followed by live Q&A. All accepted papers presented in agreement with the presentation requirements will be published by IEEE on IEEE Xplore®.

Last, and by no means the least, we would like to give recognition and special thanks to the Technical Program Committee and International Program Committee members, as well as all the Reviewers, who have contributed to making this 5th Edition possible.

We all did our best for the success of *MetroAutomotive 2025*, which we hope will stimulate the curiosity of Attendees, provide innovative ideas, and allow to meet up with established and new friends.

We wish you all an enjoyable Workshop!

General Chairs
Valentina Bianchi, *University of Parma, Italy*
Stefano Cattini, *University of Modena and Reggio Emilia, Italy*

IEEE MetroAutomotive 2025 Committee

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Marcello Vanali, University of Parma, Italy

IEEE MetroAutomotive 2025 Keynote Speakers

Plenary Session - Wednesday June 25 - H 10:00

Use of Blocked Forces Measurement Methodology to Enhance E-Axle NVH Forecast

Tomás **Pedraza**
Chassis & Powertrain NVH Performance Manager
Ferrari, Italy

ABSTRACT

Automotive companies aim to reduce development costs and time while minimizing CO2 emissions. Enhancing efficiency in NVH (Noise, Vibration, and Harshness) performance is crucial, as it can prevent late redesigns of body structures or components. Transfer Path Analysis (TPA) is a widely used diagnostic technique to identify the main propagation paths of noise or vibration into the cabin. Blocked force TPA focuses on measuring the loads (force or acoustic load) of a component on the bench.
In this presentation, the results of an experimental campaign using Blocked Force TPA on an e-axle will be discussed, along with a description of the experimental setup used to obtain accurate high-frequency forces.
These loads, which are independent of the bench's mechanical properties, can be transferred to different assemblies, such as future chassis and body structures, to improve the NVH performance forecast of the component when assembled in a car.

SPEAKER BIOGRAPHY

Tomás Pedraza holds a Master's Degree in Mechanical Engineering from University of Valladolid, in 2015 and since then he have been working on Noise, Vibration and Harshness (NVH) for the automotive industry. He joined Ferrary in 2020, where he is currently Manager on NVH for Chassis & Powertrain developing the road noise as well as e-powertrain noises for GT and Sports-cars applications.

Plenary Session - Wednesday June 25 - H 14:50

A hybrid approach to tires development for high performance cars: a proper balance of virtual modeling and track validation

Luca **Bergianti**
Director of Vehicle Dynamics and Performance - DALLARA

ABSTRACT

During a new car design, the whole process can be summarized, very roughly in a few main phases: target setting, component design or selection and parameter tuning. Defining proper and realistic targets is probably the hardest part of the process when considering timing and costing implications. Then designing/selecting components and tuning parameters to reach those targets is for engineers a potential “infinite loop” the project planning needs to contain in a proper schedule. Finally, validating the prototype represents the longest and expensive process when not properly anticipated by a strong virtual development.
One of the most crucial topics in the development of a new vehicle is the decision regarding tyre characteristics (size, compounds…). That’s where the marriage between virtual world and track validation can play a key role in streamlining the process and improving technical understanding. This keynote will describe how Dallara approached this important phase when developing the Dallara Stradale. Starting from track testing a base tire on a different car, a virtual model of this “reference” tyre was validated and used as initial baseline for the multibody virtual model of the Dallara Stradale (still in the early development stage of the design). From that point, engineers started to play and to tune the virtual model of the vehicle and of the tyres (Pacejka coefficients) building up virtual options to be driven by the development drivers at the simulator, months before production started. Those target tyres were then used by the tyre manufacturer to knead polymers, structural material and chemical components and finally produce a real tyre. Many virtual loops allowed to save a significant portion of physical testing and returned an emphasized knowledge of the car months before going effectively on track.

SPEAKER BIOGRAPHY

Birth: 11.01.1977,
07.2003: Graduation in Mechanical Engineering with focus on land vehicles (@Pisa University),

Since Dec 2004 in Dallara, after few experiences as consultant engineer in Altran for Aerospace activities,
2004: Vehicle Dynamics Engineer;
2006-07-08: F3 Race Engineer;
2008: Daytona Prototype Program Manager;
2010: Indoor Testing Manager;
2012 Static Testing & Simulation Manager;
2013 Program Manager for BU Automotive;
2018 Vehicle Dynamics Manager;
2020 LMH-LMDh Car Architecture Program Manager;
2023 Director of Vehicle Dynamics and Performance.
I'm a teamwork advocate and I'm passionate about taking care of people's motivation and full engagement.
Happily Married with Mariasole since 05.2005. Proudly father of 3 daughters: Giulia (18), Vittoria (15) and Ginevra (13).
In my (never enough) free time I like taking care of nature in my house which in a very reduced scale is halfway between a little Zoo and a Botanical Garden.

Plenary Session - Thursday June 26 - H 10:30

Motorcycles' future challenges: Ducati strategy

Simone **Di Piazza**
Ducati Motor Holding, Italy

ABSTRACT

Complexity of the products is constantly growing; new competences are needed to manage new challenges. The key for having success in the future, both in racing and production, is innovation. Ducati is well known for the sportive character of their products due to its strong racing heritage but it's also focused in making more sustainable vehicles in the future.
MotoE is the first step to contribute to the reduction of CO2 emissions; there are other research projects in development (eFuel, etc.).
Some research activities are being conducted within a European funded project with the aim of developing and promoting interventions and best practices to address light vehicles' noise and pollutant emissions.
Safety is very important for Ducati: D-Air, cornering ABS, Radar Adaptive Cruise Control and Blind Spot Detection are examples of innovations developed together with suppliers to improve safety.
V2V connectivity is a technology that can contribute do increase safety: research activities on that topics are conducted together with other OEMs within the Connected Motorcycle Consortium.

SPEAKER BIOGRAPHY

Master's Degree in Mechanical Engineering University of Bologna, 1996
In Ducati since 1996:
1996 Structural Analyst for both series production and racing
2000 Head of Simulation Department (chassis and engine)
2006 Head of R&D Services:

- Simulation Department (chassis and engine)
- Material Technologies
- Process Technologies
- Dimensional Inspection Department

- Technical Documentation

2010 Executive Master in Innovation and Technology Management, BBS
2007 - 2019 Head of Chassis Design and R&D Services
2019 – today Head of Innovation and R&D Services:

- Pre-development projects for chassis, engine, electronics and e-mobility
- Managing relationships with universities and research centres
- Managing national and European funded projects
- Managing IP for production and racing R&D departments

Plenary Session - Thursday June 26 - H 15:30

Modeling and Control Techniques in Hybrid-Electric Vehicle Subsystems

Aldo **Caraceto**
MathWorks, Italy

ABSTRACT

Vehicle electrification represents, along with autonomous driving and 'networked vehicles', one of the three pivotal hubs of the second digital transformation (currently underway) in the automotive world.
This epochal transition has opened the door to a larger adoption of technologies constantly evolving to allow an agile exploration of innovative and environmentally, socially and economically sustainable solutions.
In this event, we will examine different ways of modelling, covering the spectrum of well-defined physical systems to data-driven representations (AI), simulate vehicles from different perspectives, depending on the boundary conditions and requirements that the investigation may impose.
At the same time, we will show the benefits that simulation, automatic coding and testing platform can bring to design teams on the path to vehicle design evolutions.

SPEAKER BIOGRAPHY

Aldo Caraceto, Principal Application Engineer at MathWorks, is an expert in tools for multiphysics modelling, control system design, real-time simulation and automatic code generation. He has worked with companies in the automotive and industrial automation industries for many years. He joined MathWorks in 2004 and has held the position of Application Engineer since 2007. Previously, he worked for companies in the industrial automation industry as an electronic designer and automation engineer. Aldo holds a degree (M.S.) in Electronic Engineering from the Polytechnic University of Turin.

Plenary Session - Friday June 27 - H 13:30

Artificial Intelligence Supporting End-of-Line Decision-Making: Evolution of Testing Equipment from Measurement Systems to Test Benches

Mattia **Violi** - Mattia **Maffioletti**
HPE

ABSTRACT

This study analyzes the impact of Artificial Intelligence (AI) across the entire testing chain, from measurement systems to test benches, highlighting how the integration of data-driven models enables a more robust assessment of product performance and more effective management of testing equipment. In particular, AI enhances three key domains: intelligent monitoring of measurement system behavior, health monitoring with integrated predictive maintenance of test benches, and automated root cause analysis in response to rejects or anomalies. These capabilities contribute to improved data quality, reduced measurement uncertainty, and increased reliability of End-of-Line (EOL) decision-making processes. The study also offers a perspective on the evolving role of testing systems as intelligent, active nodes within the production network, aligned with the principles of the digital factory.

IEEE MetroAutomotive 2025 Venue

IEEE **MetroAutomotive 2025** will be held at the **Centro Santa Elisabetta**, a nice conference center in the middle of the Campus of the University of Parma.

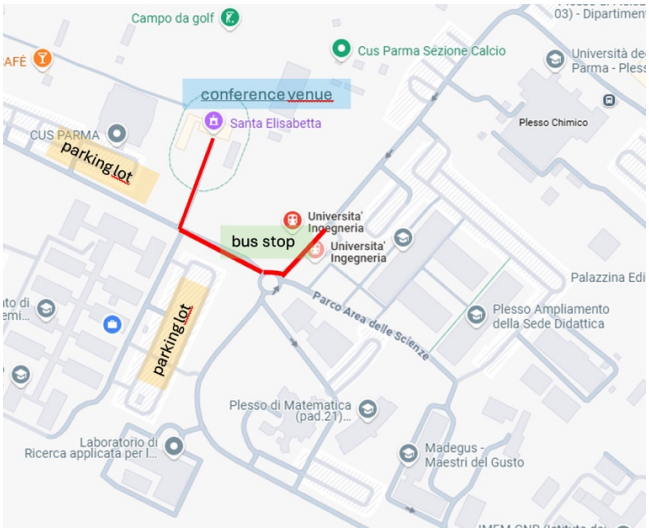
ADDRESS

Centro Santa Elisabetta - Campus of the University of Parma
Parco Area delle Scienze, 95, Parma

HOW TO REACH US

Use the QRCode to open the location on *Google Maps*

In addition to the information provided by Google Map (Centro Santa Elisabetta), to reach the conference venue from Parma station or your hotel, we suggest bus number 7 or 21.
The venue is at Centro Santa Elisabetta, and the nearest bus stop is 'INGEGNERIA' (Sede Didattica INGEGNERIA), which is 4 minutes' walk away.
Parking lots are freely available inside the Campus Area, near the conference venue.



DALLARA ACADEMY
Wednesday June 25

Join us for an exclusive special event at the renowned **Dallara Academy** on Wednesday, June 25th. The afternoon will be dedicated to a technical visit, offering participants a unique look at Dallara's cutting-edge facilities. This immersive experience includes a guided tour of the company and a thrilling session on their professional driving simulator.
To conclude this exceptional day, a **welcome party** will be held on-site at Dallara Academy, providing an excellent opportunity for networking and socializing with fellow attendees.

Transport will be provided between the conference venue and Dallara. A shuttle bus will pick up the participants at “Centro Santa Elisabetta” and at the parking lot of the shopping center “Conad Superstore Campus” at the Campus entrance (attendees who arrived by car will be required to move their car to the shopping center parking area due to the campus gates closing at 10:00 p.m.)

PROGRAM

13:30 - 14:50	**Transfer** to Dallara
14:50 - 15:50	**Keynote Session** - A hybrid approach to tires development for high performance cars: a proper balance of virtual modeling and track validation - Luca Bergianti, DALLARA
15:50 - 16:50	**Technical Sessions**
16:50 - 18:50	**Technical Visit** to DALLARA
18:50 - 20:30	**Welcome Party** - DALLARA
20:30 - 21:20	**Transfer** to Parma

IEEE MetroAutomotive 2025 Gala Dinner

The **MetroAutomotive 2025 Gala Dinner** will be held at 'Antica Trattoria Leoni', on the hills of Felino, situated in a green environment and overlooking the Parma valley with an amazing view, on **Thursday June 26**.

A **shuttle bus** will pick up the participants from **Piazzale Alberto Rondani** in the center of Parma at 7:30 p.m.

Trattoria Leoni is a charming, family-run restaurant located in Barbiano, offering traditional Italian cuisine in a warm and welcoming atmosphere. Renowned for its fresh, seasonal ingredients and homemade pasta, the trattoria blends authentic flavors with a touch of local character.

Don’t miss this special occasion to enjoy a wonderful evening in an unforgettable atmosphere!

ADDRESS
Via Ricò, 42 - 43035 Felino - Parma

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Program Schedule - Wednesday, June 25

WEDNESDAY JUNE 25		
09:00 - 12:30	REGISTRATION - Centro Santa Elisabetta, Campus of the University of Parma	
09:30 - 10:00	OPENING CEREMONY - WELCOME ADDRESSES	
10:00 - 11:00	KEYNOTE SPEAKER Use of Blocked Forces Measurement Methodology to Enhance E-Axle NVH Forecast Tomás Pedraza, Chassis & Powertrain NVH Performance Manager, Ferrari, Italy	
11:00 - 11:30	COFFEE BREAK	
	Auditorium Santa Elisabetta	Sala Master
11:30 - 12:30	S1.1 - Sensors and Measurement Techniques for Improving Noise Vibration and Harshness (NVH) and Sound Quality in Automotive Industry	S1.2 - In-circuit Sensing for Automotive and Industrial Applications
12:30 - 13:30	LUNCH	
13:30 - 14:50	TRASFER TO DALLARA	
14:50 - 15:50	KEYNOTE SPEAKER A hybrid approach to tires development for high performance cars: a proper balance of virtual modeling and track validation Luca Bergianti, DALLARA	
	Room #1	Room #2
15:50 - 16:50	S2.1 - Advanced Composite Materials for Automotive: balancing Sustainability and Smart Multifunctional Materials - Part 1	S2.2 - The Smart Battery Cell: Sensors, Modeling, Diagnostics and Characterization for the Next Generation Batteries - Part 1
16:50 - 18:50	Technical Visit to DALLARA	
18:50 - 20:30	Welcome Party - DALLARA	
20:30 - 21:20	Transfer to Parma	

Program Schedule - Thursday, June 26

THURSDAY JUNE 26		
09:00 - 16:00	REGISTRATION - Centro Santa Elisabetta, Campus of the University of Parma	
	Auditorium Santa Elisabetta	Sala Master
09:00 - 10:00	S3.1 - Sensors and instruments for improving sustainable mobility - Part 1	S3.2 - Sensors, systems and methods for measuring driver performance and interaction with the vehicle - Part 1
10:00 - 10:30	COFFEE BREAK	
10:30 - 11:30	KEYNOTE SPEAKER Motorcycles' future challenges: Ducati strategy Simone Di Piazza, Ducati Motor Holding, Italy	
	Auditorium Santa Elisabetta	Sala Master
11:30 - 12:30	S4.1 - Sensors and instruments for improving sustainable mobility - Part 2	S4.2 - Sensors, systems and methods for measuring driver performance and interaction with the vehicle - Part 2
12:30 - 13:30	LUNCH	
13:30 - 15:10	S5.1 - Measurement for Improving Quality, Reliability and Safety in Automotive Applications	S5.2 - Automotive Fault Mitigation in the R-PODID European Project
15:10 - 15:30	COFFEE BREAK	
15:30 - 16:30	KEYNOTE SPEAKER Modeling and Control Techniques in Hybrid-Electric Vehicle Subsystems Aldo Caraceto, MathWorks, Italy	
16:30 - 17:30	PANEL organized by IEEE WiE Italy Section AG	
19:30 - 20:00	Transfer to Gala Dinner - Piazzale Alberto Rondani	
20:00 - 22:30	Gala Dinner - Antica Trattoria Leoni	
22:30 - 23:00	Transfer to Parma	

Program Schedule - Friday, June 27

FRIDAY JUNE 27		
09:00 - 13:00	REGISTRATION - Centro Santa Elisabetta, Campus of the University of Parma	
	Auditorium Santa Elisabetta	Sala Master
09:00 - 10:40	S6.1 - Software-Defined Vehicles: Sensing, Communication, Processing, and Control	S6.2 - Open tutorials: Workshop on Measurement Practices and Challenges in Electrical Machines and Drives for Transport Applications supported by PELS TC3: Electrical Machines, Drives and Automation (Part 1)
10:40 - 11:10	COFFEE BREAK	
11:10 - 12:30	S7.1 - Design and Development and Characterization of Automotive Ranging Technologies	S7.2 - Open tutorials: Workshop on Measurement Practices and Challenges in Electrical Machines and Drives for Transport Applications supported by PELS TC3: Electrical Machines, Drives and Automation (Part 2)
12:30 - 13:30	LUNCH	
13:30 - 14:30	KEYNOTE SPEAKER Artificial Intelligence Supporting End-of-Line Decision-Making: Evolution of Testing Equipment from Measurement Systems to Test Benches Mattia Violi and Mattia Maffioletti, HPE, Italy	
	Auditorium Santa Elisabetta	Sala Master
14:30 - 16:10	S8.1 - The Smart Battery Cell: Sensors, Modeling, Diagnostics and Characterization for the Next Generation Batteries - Part 2	S8.2 - Advanced Composite Materials for Automotive: balancing Sustainability and Smart Multifunctional Materials - Part 2
16:10 - 16:30	CLOSING AND AWARD CEREMONY	

Technical Program - Wednesday, June 25

09:00 - 12:30	*Centro Santa Elisabetta, Campus of the University of Parma* **REGISTRATIONS**

09:30 - 10:00	*Auditorium Santa Elisabetta* **OPENING CEREMONY - WELCOME ADDRESSES**

10:00 - 11:00	*Auditorium Santa Elisabetta* **PLENARY SESSION - KEYNOTE SPEAKER** **Chair**: Gianmarco Battista, *University of Parma, Italy*

Use of Blocked Forces Measurement Methodology to Enhance E-Axle NVH Forecast

Tomás Pedraza, *Chassis & Powertrain NVH Performance Manager, Ferrari, Italy*

11:00 - 11:30	*Sala delle Colonne* **COFFEE BREAK**

11:30 - 12:30	*Auditorium Santa Elisabetta* **Session 1.1 - Sensors and Measurement Techniques for Improving Noise Vibration and Harshness (NVH) and Sound Quality in Automotive Industry** **Chairs:** Andrea Toscani, *University of Parma, Italy* Daniel Pinardi, *University of Parma, Italy*

11:30 **Auralizations of a Car: a Perceptual Comparative Study**
Christof Faller (Illusonic GmbH, Switzerland); Marco Olivieri (Ferrari S.p.A., Italy); Enrico Zoboli (RELAB S.r.l, Italy); Michele Ebri (Ferrari S.p.A., Italy)

11:50 **Virtual Reality for Immersive Auralization of Acoustic Vehicle Alerting Systems**
Daniel Pinardi, Marco Binelli and Angelo Farina (University of Parma, Italy); Jong-Suh Park (Hyundai Motor Company, Korea (South))

12:10 **Integrated Sensor for Distributed Monitoring of Wheel Rim Temperature in Gran Turismo Cars**
Paolo Avenali and Roberta Ramilli (University of Bologna, Italy); Mattia Valli (Bucci Composites, Italy); Marco Crescentini (University of Bologna, Italy)

11:30 - 12:30	*Sala Master* **Session 1.2 - In-circuit Sensing for Automotive and Industrial Applications** **Chairs:** Alessandro Soldati, *University of Parma, Italy* Alex Musetti, *University of Parma, Italy*

11:30 **Robust Multidimensional Temperature Sensing for Noisy Environments**
Alessandro Soldati, Alex Musetti, Enrico Panciroli and Giovanni Chiorboli (University of Parma, Italy)

11:50 **Validation of Mechanical Load Imbalance Detection in Six-Phase Surface-Mounted AC Permanent Magnet Synchronous Motor Drive**
Yasser Gritli, Claudio Rossi and Angelo Tani (University of Bologna, Italy)

12:10 **Design of Simulation Test System for Autonomous Driving of Intelligent Connected Vehicles**
Jianwen Shao (Zhejiang Institute of Metrology, China); Jiamin Huang (Zhejiang Institute of Quality Sciences, China); Cunbin Zhao and Zhengzhou Ye (Zhejiang Institute of Metrology, China); Lei Luo (Zhejiang Institute of Quality Sciences, China)

12:30 - 13:30	*Sala delle Colonne* **LUNCH**

13:30 - 14:50	**TRANSFER TO DALLARA**

A shuttle bus will pick up the participants at “Centro Santa Elisabetta” and at the parking lot of the shopping center “Conad Superstore Campus” at the Campus entrance (attendees who arrived by car will be required to move their car to the shopping center parking area due to the campus gates closing at 10:00 p.m.)

14:50 - 15:50	*Dallara Academy - Room #1* **PLENARY SESSION - KEYNOTE SPEAKER** **Chair**: Marcello Vanali, *University of Parma, Italy*

A hybrid approach to tires development for high performance cars: a proper balance of virtual modeling and track validation

Luca Bergianti, *Director of Vehicle Dynamics and Performance - DALLARA*

15:50 - 16:50	*Dallara Academy - Room #1* **Session 2.1 - Advanced Composite Materials for Automotive: balancing Sustainability and Smart Multifunctional Materials - Part 1** **Chair:** Lorena Saitta, *University of Catania, Italy*

15:50 **Chemical Recycling of Structural Carbon Fibers Reinforced Composites with Integrated Solar Cell for E-Vehicle**
Lorena Saitta, Gianluca Cicala, Claudio Tosto, Alberta Latteri and Ignazio Blanco (University of Catania, Italy); Kim Myklebust and Sara Plaga (Levante S.r.l. Società Benefit, Italy); Roberto Catenaro, Nicola Catenaro, Fabio Fazzini and Romualdo Paino (Advanced Composites Solution Srl, Italy)

16:10 **Optimization of Material Extrusion Additive Manufacturing of Silicon Carbide-Filled Filament Through Thermal Diffusivity Evaluation**
Claudio Tosto, Mattia Leonardo Parisi, Lorena Saitta, Giuseppe Recca, Ignazio Blanco and Gianluca Cicala (University of Catania, Italy)

16:30 **Eco-Friendly Surface Modifications of Flax Fibers for Enhanced Sustainable Epoxy Composite Performance**
Riccardo Miranda, Vincenzo Fiore, Rosaria Paradiso, Marco Luciano and Antonino Valenza (University of Palermo, Italy)

15:50 - 16:30 *Dallara Academy - Room #2*
Session 2.2 - The Smart Battery Cell: Sensors, Modeling, Diagnostics and Characterization for the Next Generation Batteries - Part 1
Chairs: Marco Crescentini, *University of Bologna, Italy*
Alessio De Angelis, *University of Perugia, Italy*

15:50 **A Method for Fault Simulation in Electric Batteries Using Real No-Fault Measurement Data**
Harsha Vardhana Jetti, Paolo Carbone, Alessio De Angelis and Mario Luca Fravolini (University of Perugia, Italy)

16:10 **Impact of Sensor Positioning on Temperature Measurement Accuracy in Battery Modules**
Filippo Gerbino and Davide Spaggiari (University of Parma, Italy); Ane Sainz De La Maza (Basque Research and Technology Alliance and UPV-EHU, Italy); Edorta Ibarra (University of the Basque Country, Spain); David Ansean (University of Oviedo, Spain); Danilo Santoro (University of Parma, Italy)

16:50 - 18:50 **TECHNICAL VISIT TO DALLARA**

18:50 - 20:30 *DALLARA*
WELCOME PARTY

20:30 - 21:20 **TRANSFER TO PARMA**

Technical Program - Thursday, June 26

09:00 - 16:00	*Centro Santa Elisabetta, Campus of the University of Parma* **REGISTRATIONS**

09:00 - 10:00	*Auditorium Santa Elisabetta* **Session 3.1 - Sensors and instruments for improving sustainable mobility - Part 1** **Chairs:** Salvatore Dello Iacono, *University of Brescia, Italy* Vincenzo Gallo, *University of Salerno, Italy*

09:00 **Evaluation of Deep Learning Models for State of Charge Estimation for Lithium Batteries Using Image-Encoded Electrochemical Impedance Spectroscopy Data**
Hamza Mustafa (University of Cassino and Southern Lazio, Italy & Sesnsichips Srl, Italy); Michele Vitelli (University of Cassino and Southern Lazio & Sensichips Srl, Italy); Filippo Milano and Mario Molinara (University of Cassino and Southern Lazio, Italy); Luigi Ferrigno (University of Cassino, Italy)

09:20 **Meaningful Audio Data Augmentation for Approaching Vehicles Detection**
Salvatore Dello Iacono, Alessandra Flammini and Emiliano Sisinni (University of Brescia, Italy); Daniele Buonocore, Consolatina Liguori and Vincenzo Paciello (University of Salerno, Italy)

09:40 **Towards Sustainable Mobility Through Smart Pollution Monitoring: the BME Sensor Case Study**
Enza Panzardi, Marco Tani, Elia Landi, Ada Fort and Marco Mugnaini (University of Siena, Italy); Salvatore Dello Iacono (University of Brescia, Italy)

09:00 - 10:00	*Sala Master* **Session 3.2 - Sensors, systems and methods for measuring driver performance and interaction with the vehicle - Part 1** **Chair:** Susanna Spinsante, *Università Politecnica delle Marche, Italy*

09:00 **Convolutional Autoencoder-Based Anomaly Detection in PPG Signals Using a Necklace Wearable Device**
Anna Lo Grasso (University of Udine, Italy); Pamela Zontone (University of Genoa, Italy); Antonio Affanni and Roberto Rinaldo (University of Udine, Italy)

09:20 **Unobtrusive Multimodal Driver Stress Detection from ECG and PPG Using TCNs**
Massimo Micolitti and Pierangelo M Rapa (University of Bologna, Italy); Davide Cassanelli (Università degli studi di Modena e Reggio Emilia, Italy); Luca Benini (Swiss Federal Institute of Technology (ETH), Switzerland); SImone Benatti (University of Modena and Reggio Emilia, Italy)

09:40 **Skin Conductance Acquisition from Different Hand Sites: Towards an Instrumented Steering Wheel**
Grazia Iadarola (Polytechnic University of Marche, Italy); Alessandro Marini (Università Politecnica delle Marche, Italy); Susanna Spinsante (Università Politecnica Delle Marche, Italy)

10:00 - 10:30	*Sala delle Colonne* **COFFEE BREAK**

10:30 - 11:30	*Auditorium Santa Elisabetta* **PLENARY SESSION - KEYNOTE SPEAKER** **Chair**: Valentina Bianchi, *University of Parma, Italy*

Motorcycles' future challenges: Ducati strategy

Simone Di Piazza, *Ducati Motor Holding, Italy*

11:30 - 12:30	*Auditorium Santa Elisabetta* **Session 4.1 - Sensors and instruments for improving sustainable mobility - Part 1** **Chairs:** Salvatore Dello Iacono, *University of Brescia, Italy* Vincenzo Gallo, *University of Salerno, Italy*

11:30 **Application of the LoRaWAN Technology for Managing E-Bikes Charging in Urban Scenario**
Salvatore Dello Iacono (University of Brescia, Italy); Davide Astolfi (Università di Brescia, Italy); Antony Vasile, Marco Pasetti, Alessandro Depari, Paolo Ferrari, Alessandra Flammini, Stefano Rinaldi and Emiliano Sisinni (University of Brescia, Italy)

11:50 **On the Feasibility of LoRaWAN Communication in a Smart Road Sensor Network**
Giovanni Betta (University of Cassino, Italy); Domenico Capriglione (University of Cassino and Southern Lazio, Italy); Luigi Ferrigno (University of Cassino, Italy); Gianfranco Miele and Keerthana Velusamy (University of Cassino and Southern Lazio, Italy)

12:10 **Application of Fiber Optic Polarization Sensors in Automotive Industry**
Zdenek Vylezich (University of Defence in Brno, Czech Republic); Martin Kyselak (University of Defense, Czech Republic); Jiri Vavra (University of Defence, Czech Republic)

11:30 - 12:30	*Sala Master* **Session 4.2 - Sensors, systems and methods for measuring driver performance and interaction with the vehicle - Part 1** **Chair:** Susanna Spinsante, *Università Politecnica delle Marche, Italy*

11:30 **SICBoard: a Racing Motorbike Measurement and Dashboard System for Real-Time Sensor Analysis**
Laura Arruzzoli, Federico Randazzo, Gianmarco Interdonato, Nicola Donato, Giacomo Risitano and Dario Milone (University of Messina, Italy)

11:50 **Unobtrusive Driver's Attitude Monitoring Through an Instrumented Steering Wheel**
Valeria Bruschi (Marche Polytechnic University, Italy); Stefania Cecchi (UNIVPM, Italy); Alessandro Terenzi, Denis Di Leo and Gianluca Ciattaglia (Università Politecnica delle Marche, Italy); Susanna Spinsante (Università Politecnica Delle Marche, Italy)

12:10 **In Car Speech Detection with mmWave Radars**
Gianluca Ciattaglia (Università Politecnica delle Marche, Italy); Michela Raimondi and Antonio Nocera (Università Politecnica Delle Marche, Italy); Maria Gardano (Università Politecnica delle Marche, Italy); Susanna Spinsante (Università Politecnica Delle Marche, Italy); Ennio Gambi (Universita' Politecnica Delle Marche, Italy)

12:30 - 13:30 *Sala delle Colonne*
LUNCH

13:30 - 15:10 *Auditorium Santa Elisabetta*
Session 5.1 - Measurement for Improving Quality, Reliability and Safety in Automotive Applications
Chairs: Lorenzo Ciani, *University of Florence, Italy*
Gabriele Patrizi, *University of Florence, Italy*

13:30 **FMECA Analysis on Driverless System for a Formula Student Vehicle**
Gabriele Patrizi (University of Florence, Italy); Edoardo Pippi (University of Florence & Firenze Race Team, Italy); Gabriele Giannini, Niccolò Cocchi and Lorenzo Ciani (University of Florence, Italy)

13:50 **Towards a Novel Indirect Battery Health Indicator Based on Electrochemical Impedance Spectroscopy for RUL Estimation in Electric Vehicles**
Gabriele Patrizi, Fabio Canzanella and Lorenzo Ciani (University of Florence, Italy)

14:10 **Deployment of an Anomaly Detection Methodology Based on Generative Adversarial Network**
Marco Carratù, Vincenzo Gallo and Paolo Sommella (University of Salerno, Italy); Antonio Pietrosanto (University of Salerno & CEO of Metering Research srl, Italy)

14:30 **ISO-15118 Manipulation for Field Calibration of DC Electric Vehicle Supply Equipment**
Dario Costanzo (Università degli Studi della Campania Luigi Vanvitelli, Italy); Antonio Delle Femine, Daniele Gallo, Carmine Landi and Mario Luiso (University of Campania Luigi Vanvitelli, Italy)

14:50 **Charging of an AC Three-Phase Electric Vehicle: Power Quality Analysis Up to 150 kHz**
Giovanni Artale and Valentina Cosentino (University of Palermo, Italy); Dario Costanzo (Università degli Studi della Campania Luigi Vanvitelli, Italy); Antonio Delle Femine (University of Campania Luigi Vanvitelli, Italy); Dario Di Cara (National Research Council, Italy); Vito Ditta (National Research Council - Institute of Marine Engineering, Italy); Daniele Gallo and Mario Luiso (University of Campania Luigi Vanvitelli, Italy); Nicola Panzavecchia (National Research Council, Italy)

13:30 - 15:10 *Sala Master*
Session 5.2 - Automotive Fault Mitigation in the R-PODID European Project
Chairs: Marco Crescentini, *University of Bologna, Italy*
Pier Andrea Traverso, *University of Bologna, Italy*

13:30 **Silicon-Carbide Power Device X-Ray Screening via Attention-Based Deep Network for a Robust Traction-Inverter in Electric Vehicles**
Francesco Rundo (University of Catania, Italy); Giulia Castagnolo (ST Microelectronics, Italy); Carmelo Pino (STMicroelectronics, Italy); Massimo Orazio Spata (University of Catania & STMicroelectronics, Italy); Angelo Alberto Messina (STMicroelectronics, Italy); Sebastiano Battiato (University of Catania, Italy)

13:50 **Investigation into the Aging Mechanisms of a SiC-Based Power MOSFET by Thermal and Thermomechanical Analysis**
Moreno d'Ambrosio, Chiara Tripodi, Francesca Garesci, Daniele Cosio and Domenico Bonanno (University of Messina, Italy); Francesco Rundo (University of Catania, Italy); Angelo Alberto Messina (STMicroelectronics, Italy); Antonio Imbruglia (STMicroelectronics, France); Michele Calabretta (STMicroelectronics, Italy); Salvatore Patanè (University of Messina, Italy)

14:10 **Operating Condition Prognosis of Multi-Phase Electric Drives with Machine Learning Models**
Stefano Breda, Monika Stipsitz, Tyson Alexander Dagorne, Varaha Satya Bharath Kurukuru and Ulrich Gaier (Silicon Austria Labs GmbH, Austria); Roberto Petrella (Silicon Austria Labs GmbH, Austria & University of Udine, Italy)

14:30 **Integrated Hall-Effect Broadband Current Sensor for SiC Traction Inverter**
Mattia Mengozzi and Gian Piero Gibiino (University of Bologna, Italy); Jacopo Ferretti (Alma Mater Studiorum - Università di Bologna, Italy); Mariano Nerone (HPE Group, Italy & University of Bologna, Italy); Igor Valič (HPE Group, Italy); Filippo Ferrarese (HPE s.r.l., Italy); Sana Fatima Syeda, Marco Crescentini and Pier Andrea Traverso (University of Bologna, Italy)

14:50 **Investigation into an NFC-Based Monitoring Sensor Node for Electric Motor: Compression Algorithms for Baud-Rate Constraints**
Matteo Zauli (University of Bologna, Italy); Igor Valič (HPE Group, Italy); Mariano Nerone (HPE Group, Italy & University of Bologna, Italy); Jacopo Ferretti (Alma Mater Studiorum - Università di Bologna, Italy); Filippo Ferrarese (HPE s.r.l., Italy); Luca De Marchi (University of Bologna, Italy)

15:10 - 15:30	*Sala delle Colonne* **COFFEE BREAK**

15:30 - 16:30	*Auditorium Santa Elisabetta* **PLENARY SESSION - KEYNOTE SPEAKER** **Chair**: Valentina Bianchi, *University of Parma, Italy*

Modeling and Control Techniques in Hybrid-Electric Vehicle Subsystems

Aldo Caraceto, *MathWorks, Italy*

16:30 - 17:30	*Auditorium Santa Elisabetta* **Panel IEEE WiE Italy Section AG** **Chair**: Roberta Di Pace, *University of Salerno, Italy*

19:30 - 20:00	**TRANSFER TO GALA DINNER**

A shuttle bus will pick up the participants from **Piazzale Alberto Rondani** in the center of Parma at 19.30.

20:00 - 22:30	*Antica Trattoria Leoni - Felino (Parma)* **GALA DINNER**

22:30 - 23:00	**TRANSFER TO PARMA**

Technical Program - Friday, June 27

09:00 - 13:00	*Centro Santa Elisabetta, Campus of the University of Parma* **REGISTRATIONS**

09:20 - 10:40	*Auditorium Santa Elisabetta* **Session 6.1 - Software-Defined Vehicles: Sensing, Communication, Processing, and Control** **Chairs:** Luca Davoli, *University of Parma, Italy* Gianluigi Ferrari, *University of Parma, Italy*

09:20 **Distribution of Error Rate Budgets According to Functional Scenarios in the Development and Validation of Mobility Systems**
Sebastian Siegl (Audi AG, Germany); Amir Cenanovic and Minhao Qiu (AUDI AG, Germany)

09:40 **Ontology-Driven Metrology Data Management for Wireless Charging, Battery Management and Predictive Maintenance in Electrical Vehicles**
Ibrahim Arif (Ergünler R&D Co.Ltd. (ERARGE), Isparta, Türkiye); Tolga Baykal (Togi Teknoloji Ltd. Co., Kocaeli, Türkiye); Serhat Ege İnanç (AI4SEC ÖÜ, Tallinn, Estonia); Salih Halit Ergün (Ergtech Research GmbH, Zurich, Switzerland); Emre Dinçer (Togi Teknoloji Ltd. Co., Kocaeli, Türkiye); Muhammed Enis Şen (Bitnet Bilişim Hizmetleri Co. Ltd., İstanbul, Türkiye); Ali Serdar Atalay (AI4SEC ÖÜ, Tallinn, Estonia); Salih Ergun and Alper Kanak (Ergtech Research GmbH, Zurich, Switzerland)

10:00 **Federated Learning-Assisted Privacy-Preserving Service Placement in Software-Defined Vehicles**
Anum Nawaz, Luca Davoli, Laura Belli and Gianluigi Ferrari (University of Parma, Italy)

10:20 **DISTILLO Framework: a Novel Knowledge Distillation Platform for Advanced Intelligent Solution Deployment over Automotive-Grade Devices**
Giulia Castagnolo (ST Microelectronics, Italy); Carmelo Pino, Michele Calabretta and Angelo Alberto Messina (STMicroelectronics, Italy); Salvatore Patanè, Francesca Garesci and Moreno d'Ambrosio (University of Messina, Italy); Sebastiano Battiato and Francesco Rundo (University of Catania, Italy)

09:00 - 10:55 *Sala Master*

Open tutorials: Workshop on Measurement Practices and Challenges in Electrical Machines and Drives for Transport Applications supported by PELS TC3: Electrical Machines, Drives and Automation (Part 1)

Chairs: Giacomo Scelba, *University of Catania, Chair of PELS TC3: Electrical Machines, Drives and Automation*
Stefano Nuzzo, *University of Modena and Reggio Emilia, Secretary of PELS TC3: Electrical Machines, Drives and Automation*

09:00 **Welcome and Opening**

09:10 **Testing of high-performance electrical drives: challenges and solutions**
Matias Troncoso, Ferrari Spa

09:45 **Supporting eMachines and Drives Design Through Testing & Validation: Dumarey Experience and Use-Cases**
Vincenzo Madonna, Cristiano Mannucci, DUMAREY Automotive S.p.A.

10:20 **High-performance measurements of electrical machines and drives**
Matteo Ribichini, DeweSOFT

10:40 - 11:10 *Sala delle Colonne*

COFFEE BREAK

11:10 - 12:30 *Auditorium Santa Elisabetta*

Session 7.1 - Design and Development and Characterization of Automotive Ranging Technologies

Chairs: Jan Sobotka, *Czech Technical University in Prague, Czech Republic*
Davide Cassanelli, *University of Modena and Reggio Emilia, Italy*

11:10 **Investigating Temperature Effects in Directly Modulated Laser-Diodes in Coherent FMCW-LiDAR Systems**
Max Julius Bode (Fraunhofer HHI, Germany); Sarah Cwalina (Fraunhofer Heinrich Hertz Institute, Germany); Markus Nölle (HTW Berlin - University of Applied Sciences, Germany); Christoph Kottke (Fraunhofer Heinrich Hertz Institute, Germany); Volker Jungnickel (Fraunhofer Heinrich Hertz Institute & Technische Universität Berlin, Germany); Ronald Freund (HHI Fraunhofer, Germany)

11:30 **Effect of Multirate Sampling on Synthetic Target Doppler Velocity**
Jan Sobotka and Viktor Adler (Czech Technical University in Prague, Czech Republic)

11:50 **Towards Accurate Reconstruction of Racing Tracks Using an Autonomous Mobile Robot**
Andrea Gorfer (University of Trento, Italy & Ducati Motor Holding SpA, Italy); Andrea Pierantoni (Ducati Motor Holding SpA, Italy); Daniele Fontanelli (University of Trento, Italy)

12:10 **Simple Test Bench and Metrics for Analyzing and Comparing LiDARs Performance in the Presence of Dust**
Davide Cassanelli (Università degli studi di Modena e Reggio Emilia, Italy); Stefano Cattini (University of Modena and Reggio Emilia, Italy); Lorenzo Medici (CNH Industrial Italia spa, Italy); Luigi Rovati (University of Modena and Reggio Emilia, Italy)

11:15 - 12:30	*Sala Master* **Open tutorials: Workshop on Measurement Practices and Challenges in Electrical Machines and Drives for Transport Applications supported by PELS TC3: Electrical Machines, Drives and Automation (Part 2)** **Chairs:** Giacomo Scelba, *University of Catania, Chair of PELS TC3: Electrical Machines, Drives and Automation* Stefano Nuzzo, *University of Modena and Reggio Emilia, Secretary of PELS TC3: Electrical Machines, Drives and Automation*

11:15 **Numerical and experimental analysis of the drift generated by 3D effects on the performance estimation of radial flux PMSMs**
Nicola Matteazzi, Giuseppe Porto, HPE Group & Blue Matter

11:50 **Challenges & Solutions in modern vehicle testing**
Riccardo Basile, Andrea Soriello, Reinova

12:25 **Conclusion**

12:30 - 13:30	*Sala delle Colonne* **LUNCH**

13:30 - 14:30	*Auditorium Santa Elisabetta* **PLENARY SESSION - KEYNOTE SPEAKER** **Chair**: Pier Andrea Traverso, *University of Bologna, Italy*

Artificial Intelligence Supporting End-of-Line Decision-Making: Evolution of Testing Equipment from Measurement Systems to Test Benches

Mattia Violi and Mattia Maffioletti, *HPE*

14:30 - 15:30	*Auditorium Santa Elisabetta* **Session 8.1 - The Smart Battery Cell: Sensors, Modeling, Diagnostics and Characterization for the Next Generation Batteries - Part 2** **Chairs:** Marco Crescentini, *University of Bologna, Italy* Alessio De Angelis, *University of Perugia, Italy*

14:30 **On the Feasibility of EIS-Based Online Battery Monitoring Assessed in Automotive Grade Environment**
Roberta Ramilli (University of Bologna, Italy); Pasquale Romano (Alten Italia S.p.A, Italy); Mattia Giuliano (Centro Ricerche FIAT, Italy); Nello Li Pira (CENTRO RICERCHE FIAT, Italy); Marco Crescentini and Pier Andrea Traverso (University of Bologna, Italy)

14:50 **Experimental Investigation of Li-Ion Cylindrical Cell Thermal Response Through Heat Flux Measurement**
Nicolo Federico Quattromini (University of Modena and Reggio Emilia, Italy); Luca Trussardi (Modena MMR Hybrid Race Team, Italy); Vito Lo Re (Modena MMR E-driverless Race Team, Italy); Giovanni Franceschini, Stefano Nuzzo and Davide Barater (University of Modena and Reggio Emilia, Italy)

15:10 **Characterization of the Dynamic Response of a Fuel Cell Through EMA and Vibration Testing**
Hadi Eidinejad, Alessandro Rivola and Alberto Martini (University of Bologna, Italy)

14:30 - 16:10 *Sala Master*
Session 8.2 - Advanced Composite Materials for Automotive: balancing Sustainability and Smart Multifunctional Materials - Part 2
Chair: Lorena Saitta, *University of Catania, Italy*

14:30 **Mechanical Performance of a Continuous Vegetable Fibre Reinforced Unidirectional Composite**
Giulia Ronconi, Marco Zanelli and Andrea D'iorio (University of Ferrara, Italy); Pietro Russo (CNR, Italy); Nicola Pritoni (University of Ferrara, Italy); Giulia Fredi (University of Trento, Italy); Nina Graupner (HSB Hochschule Bremen, Italy); Valentina Mazzanti (University of Ferrara, Italy)

14:50 **Thermomechanical and Chemical Characterization of Bio-Based and Fully-Recyclable Glass Fibers Reinforced Composites Produced via Hot Pressing**
Lorena Saitta, Gianluca Cicala, Claudio Tosto, Ignazio Blanco and Maide Bucolo (University of Catania, Italy); Giuseppe Cirrone and Luca Zinna (NTET Group, Italy)

15:10 **Flax Fiber vs. Glass Fiber Composites: a Comparative Study with Tailored Thermoset Matrices**
Vito Gigante (Università di Pisa, Italy); Bianca Dal Pont, Laura Aliotta and Andrea Lazzeri (University of Pisa, Italy)

15:30 **Bio-Polyamide 11 Composites with Short Basalt Fiber as Sustainable Approach for Automotive Interiors**
Laura Aliotta and Bianca Dal Pont (University of Pisa, Italy); Vito Gigante (Università di Pisa, Italy)

15:50 **A Microcontroller Based Optimized Framework for the State of Charge Estimation of a Lithium Ion Battery**
Sadia Ali (University of Parma, Italy & University of Bologna, Italy); Valentina Bianchi and Ilaria De Munari (University of Parma, Italy)

16:10 - 16:30	*Auditorium Santa Elisabetta* **CLOSING AND AWARD CEREMONY**