



2024 IEEE INTERNATIONAL WORKSHOP ON

# Metrology for Automotive

BOLOGNA, JUNE 26-28, 2024

[ FINAL PROGRAM ]

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# Welcome Message from the General Chairs

On behalf of the Organizing Committee, we warmly welcome you to the **2024 IEEE International Workshop on Metrology for Automotive (MetroAutomotive)**. This year the 4th edition of the Workshop will be held at Palazzo Hercolani, one of the most prestigious XVIII century aristocratic residences in the historic centre of Bologna, which represents a unique synthesis of neoclassical and baroque architectural styles achieved by the design of Angelo Venturoli.

After the first edition launched in 2021, which suffered from the global lockdown and travel restrictions but nonetheless recorded a successful participation in a virtual format, and two successive editions held in Modena, the Workshop returns to Bologna in 2024 as an already well-established event capable of collecting the interest of a growing community around the role of instrumentation, sensing, and measurement technologies in the field of Automotive.

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 2024 IEEE MetroAutomotive Technical Program consists of 4 keynotes, 7 technical sessions, and a Panel Session focused on Military Automotive Measurement. In addition, the Program will open with a presentation held by the Director General of MOST - The Italian National Center for Sustainable Mobility - to offer a general overview about the implementation of the NextGenerationEU Funding Plan in the framework of the Italian Automotive Sector.

The 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. Among the technical sessions, we have scheduled 6 special sessions, and we would like to thank the Organizers of these special sessions for their cooperation and support in organizing the Workshop.

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

- o Domenico Di Grazia, from STMicroelectronics: *Satellite Modernization, Precise Positioning and Sensor Fusion: Unlocking the Full Potential of GNSS in Automotive Applications*
- o Silvio Rabbolini, from Ferrari: *Use of optical surface temperature measurement on high speed turbine to optimize engine efficiency*

- o Salvatore Afeltra and Andrea Sangermano, from AVL: *E-motor testing: Tools and methodologies*
- o Mirko Marracci, from University of Pisa: *Characterization of lithium batteries for automotive applications: from laboratory testing to field data collection*

As in the previous editions, the 2024 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, in the technologies and approaches pursued in the Automotive Sector.

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

Last, and by no means the least, we have 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 4th Edition possible.

We all did our best for the success of MetroAutomotive 2024, 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**

Pier Andrea Traverso, *University of Bologna, Italy*  
Federico Tramarin, *University of Modena and Reggio Emilia, Italy*

# IEEE MetroAutomotive 2024 Committee

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Jan Sobotka, Czech Technical University in Prague, Czech Republic

# IEEE MetroAutomotive 2024 Keynote Speakers

Plenary Session - Wednesday June 26 - H 14:40

## E-motor testing: Tools and methodologies



**Salvatore Afeltra**

AVL



**Andrea Sangermano**

AVL

### ABSTRACT

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The development time for e-drive systems is getting shorter and shorter. Different e-motor technologies such as Permanent Magnet Synchronous Motors (PMSM), Asynchronous Motors (ASM) or Electrically Excited Synchronous Motors (EESM), new inverter technologies such as Silicon Carbide (SiC), but also different powertrain concepts make the complexity of developing and testing modern e-drive systems obvious. AVL has a broad portfolio of dedicated e-motor test systems, software, tools and processes to test and validate these modern e-drive systems in the shortest time and with the highest quality standards.

### SPEAKERS BIOGRAPHY

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#### **SALVATORE AFELTRA**

Master Degree in Mechanical Engineering at Università degli Studi di Napoli - Federico II.

I have covered, for several years, the role of calibration engineer for Diesel Engines application in VM Motori, Jaguar-Land Rover, Denso, FPT Industrial and Stellantis.

In the last two years, I decided to quit the technical work for a technical sales.

Since the 1st February 2023, I have been working as Technical Sales Specialist for AVL product portfolio for Italian market and I am responsible for combustion, consumption & e-power products.

## **ANDREA SANGERMANO**

Master Degree in Mechanical Engineering for Energy and Environment at Università degli Studi di Napoli - Federico II.

I have covered, for several years, the role of calibration engineer for Gasoline Engines application in Stellantis, with focus on emission, drivability and base-engine.

Since the 15th April 2023, I have been working as Technical Sales Specialist for AVL product portfolio for Italian market and I am responsible for Electric Propulsion Test System, Battery and E-Motor Emulation products .

## Plenary Session - Thursday June 27 - H 14:20



# Use of optical surface temperature measurement on high speed turbine to optimize engine efficiency

**Silvio Rabbolini**

*Ferrari*

### ABSTRACT

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The necessity to be compliant to worldwide legislation in increasingly demanding CO2 reduction leads to improvements in ICEs power and efficiency. Therefore, recently the attention has been shifted on engine cycle modification, stoichiometric combustion and on the increase of temperatures at turbine inlet of the turbocharging units.

In this presentation, the results of an experimental campaign, performed to check turbine wheel temperatures during real engine applications, will be discussed together with a description of the experimental setup.

These maps were employed to improve mathematical CFD models, which are the roots of a life assessment model that can track turbocharger health in real time, extending traditional operating ranges and improving overall engine efficiency.

### SPEAKER BIOGRAPHY

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**Silvio Rabbolini** is a mechanical engineer at Ferrari. He received a Ph.D in machine design from Politecnico di Milano in 2015, focusing on fatigue life assessment of high temperature alloys. He has worked in the field of turbomachinery design for over 15 years, mainly focusing on fatigue life assessment of rotors and vessels, together with rotordynamics. He joined Ferrari in 2019, where he is currently developing turbocharging systems for GT applications.



## Plenary Session - Friday June 28 - H 09:30



# Satellite Modernization, Precise Positioning and Sensor Fusion: Unlocking the Full Potential of GNSS in Automotive Applications

**Domenico Di Grazia**

*STMicroelectronics*

### ABSTRACT

The introduction of Global Positioning System (GPS) technology has revolutionized the field of localization, navigation, and synchronizing receiving equipment in the automotive industry.

As autonomous driving applications become more prevalent, the requirements for onboard GNSS (Global Navigation Satellite System) receivers are increasing. Position accuracy, protection levels, high availability, robustness of operation, and integrity are the priorities shaping a new class of automotive components and systems. These systems must be able to operate reliably in a range of environments and conditions, including urban areas, tunnels, and regions with poor satellite visibility.

The aim of the keynote is to guide the audience through the evolutionary path of Satellite Navigation, from GPS to GNSS, introducing the concept of Sensor Fusion and Satellite Modernization for Precise Position target application and to explain the milestones and trends in this sector. The lecture will provide insights into the latest developments in GNSS technology and how it is being used in the automotive industry to improve safety, efficiency, and performance.

### SPEAKER BIOGRAPHY

**Domenico Di Grazia** holds a Master's degree in Telecommunication Engineering from University Federico II of Naples, Italy, in 2001 (with honors) and currently collaborates with University of Naples "Parthenope". He is a Principal Engineer in GNSS System Architecture and SW R&D Team at STMicroelectronics. He has been working in the GNSS field since 2007 and has deep knowledge of embedded GNSS systems, an area in which he holds several patents and has authored many articles.

## Plenary Session - Friday June 28 - H 13:50



# Characterization of lithium batteries for automotive applications: from laboratory testing to field data collection

**Mirko Marracci**

*University of Pisa, Italy*

### ABSTRACT

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The talk aims to review and discuss the techniques available for the experimental characterization of lithium batteries.

Starting with data declared by cell manufacturers and common, standardized and non-standardized characterization methodologies, obtainable data, advantages and critical points will be discussed.

A space will be reserved for modeling and perspectives obtainable with field measurements with a focus on automotive applications.

### SPEAKER BIOGRAPHY

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**Mirko Marracci** (Senior Member, IEEE) received the M.S. degree in electrical engineering and the Ph.D. degree in Energetic from the University of Pisa, Pisa, Italy, in 2001 and 2005, respectively. Since 2005, he has been with the University of Pisa where he is currently an Associate Professor of Electrical Measurements with the Department of Energy, Systems, Territory and Construction Engineering.

Since 2018, he has been the Chair of the Master's Degree Program in Electrical Engineering at the University of Pisa.

His main lines of research involve measurements for characterization of materials, components and systems, measurements for electromagnetic compatibility, storage systems and metrological development and characterization of measurement methods.

# IEEE MetroAutomotive 2024 Invited Talk

Wednesday June 26 - H 10:30



## Driving Innovation in Sustainable Mobility with MOST

**Gianmarco Montanari**

*MOST - CENTRO NAZIONALE PER LA MOBILITÀ SOSTENIBILE*

### ABSTRACT

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The Centro Nazionale per la Mobilità Sostenibile - MOST, in collaboration with 24 universities, the CNR, and 24 large companies, has the mission of implementing modern, sustainable, and inclusive solutions throughout the national territory. Focused on aerial mobility, sustainable road vehicles, waterway transportation, rail transport, light vehicles, and active mobility, it adopts the "Hub&Spoke" model with the MOST Hub and 14 Spoke Leaders to foster cooperation. We are investing in pilot projects (PoC) that explore emerging technologies and innovative solutions, aiming for scalability and revolutionizing mobility. MOST is also at the center of flagship projects that integrate advanced sensors, artificial intelligence, and new materials. We support startups by financing young companies that develop revolutionary technologies in sustainable mobility. These investments promote innovation and create new opportunities for economic growth and employment. Additionally, we incentivize research with cascade funding to explore new fronts in sustainable mobility.

### SPEAKER BIOGRAPHY

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Actually Director General of MOST Foundation (National Center for Sustainable Mobility). He has a long professional experience as CEO / DG in different field as Automotive, Consultancy, Banking, Public Administration, Research Management at Italian and International Level. With 5 Degrees and several specializations in Business and Innovation Management in prestigious business schools (Harvard, Columbia, Insead, IMD, ...) is recognised expert in Innovation and Corporate Governance Management in private and public sectors. He was awarded as "Commendatore of Merit of the Italian Republic" by the President of the Republic Mattarella.

# IEEE MetroAutomotive 2024 Venue

**IEEE MetroAutomotive 2024** will be held at **Palazzo Hercolani**.

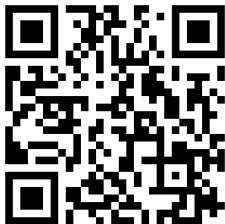
The Palazzo Hercolani is a large Rococo or Neoclassic-style palace in Strada Maggiore in central Bologna, which now serves as the offices for the Political Science Department (Facoltà di Scienze Politiche) of the University of Bologna.



Palazzo Hercolani was called after the family of the same name and was built by the Bologna architect Angelo Venturoli at the end of the 18th century in Strada Maggiore.

The exterior features a classical style that heralds back to the architecture of the 16th century, whilst the grand staircase inspired by Baroque theatricality is the last monumental staircase constructed in the city.

The interior features many opulently decorated rooms including the particularly beautiful Boschereccia.



## ADDRESS

Str Maggiore, 45  
Bologna

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

# IEEE MetroAutomotive 2024 Social Events

## WELCOME PARTY

Wednesday June 26 - H 19:00

The Welcome Party will be held at "**Il Caffè della Corte**" Bistrot on **Wednesday June 26 - 19.00**.



### ADDRESS

Corte Isolani, 5b  
Bologna

## SOCIAL DINNER

Thursday June 27 - H 19:45

The Gala Dinner will be held at Ristorante "**Da Cesari**" on **Thursday June 27 - 19.45**.

In the historic center of Bologna and near Piazza Maggiore, the "Da Cesari" restaurant boasts a fifty year old activity and it is one of the typical restaurants in Bologna with regional cuisine.



# Cesari

### ADDRESS

Via De' Carbonesi, 8  
Bologna

# IEEE MetroAutomotive 2024 Patronages



## IEEE MetroAutomotive 2024 Sponsors



# Program Schedule - Wednesday, June 26

WEDNESDAY, JUNE 26	
10:00 - 10:30	OPENING CEREMONY
10:30 - 11:00	INVITED TALK - Driving Innovation in Sustainable Mobility with MOST Gianmarco Montanari, MOST - Centro Nazionale per la Mobilità Sostenibile Gianmarco Montanari
11:00 - 12:20	SESSION 1 - General Track
12:20 - 13:40	LUNCH
13:40 - 14:40	SESSION 2 - Vehicle Radar Sensors - Simulation, Testing, Measurement and Communication
14:40 - 15:20	KEYNOTE SESSION - E-motor testing: Tools and methodologies S. Afeltra - A. Sangermano - AVL
15:20 - 15:45	COFFEE BREAK
15:45 - 17:10	MILITARY METROLOGY FOR AUTOMOTIVE
17:10 - 18:30	SESSION 3 - Design, Characterization and Validation of Sensors and Measuring Systems for Autonomous Driving
19:00	WELCOME PARTY - "Il Caffè della Corte" Bistrot Corte Isolani 5b, Bologna



# Program Schedule - Thursday, June 27

THURSDAY, JUNE 27	
09:30 - 10:50	SESSION 4 - Measurement for Improving Quality, Reliability and Safety in Automotive Applications
10:50 - 11:20	COFFEE BREAK
11:20 - 13:00	SESSION 5 - The Smart Battery Cell: Sensors, Modeling, Diagnostics and Characterization for the Next Generation Batteries
13:00 - 14:20	LUNCH
14:20 - 15:10	KEYNOTE SESSION - Silvio Rabbolini - Ferrari Use of optical surface temperature measurement on high speed turbine to optimize engine efficiency
15:10 - 16:50	SESSION 6 - Smart Metering for e-Mobility and Charging Infrastructure
16:50 - 17:20	COFFEE BREAK
17:20 - 18:00	IEEE WIE Italy Section AG - Panel Exploiting the gender diversity impact in the Automotive sector
19:45	GALA DINNER - Restaurant "Da Cesari" Via Dè Carbonesi 8, Bologna

## Program Schedule - Friday, June 28

FRIDAY, JUNE 28	
09:30 - 10:20	KEYNOTE SESSION - Domenico Di Grazia - STMicroelectronics Satellite Modernization, Precise Positioning and Sensor Fusion: Unlocking the Full Potential of GNSS in Automotive Applications
10:20 - 10:50	COFFEE BREAK
10:50 - 12:30	SESSION 7 - Sensors, systems and methods for measuring driver performance and interaction with the vehicle
12:30 - 13:50	LUNCH
13:50 - 14:30	KEYNOTE SESSION - Mirko Marracci - University of Pisa, Italy Characterization of lithium batteries for automotive applications: from laboratory testing to field data collection
14:30 - 15:30	CLOSING AND AWARD CEREMONY

# Technical Program - Wednesday, June 26

09:00 - 18:30	Palazzo Hercolani <b>REGISTRATIONS</b>
10:00 - 10:30	Palazzo Hercolani - Sala dei Poeti <b>OPENING CEREMONY</b>
10:30 - 11:00	Palazzo Hercolani - Sala dei Poeti <b>INVITED TALK</b> <b>Chair:</b> Pier Andrea Traverso, <i>University of Bologna, Italy</i>

## Driving Innovation in Sustainable Mobility with MOST

Gianmarco Montanari, *MOST - Centro Nazionale per la Mobilità Sostenibile*

11:00 - 12:20	Palazzo Hercolani - Sala dei Poeti <b>Session 1 - General Track</b> <b>Chairs:</b> Marco Crescentini, <i>University of Bologna, Italy</i> Gian Piero Gibiino, <i>University of Bologna, Italy</i>
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- 11:00 A Testing Environment to Support the Design of Innovative Car Audio Systems Based on Electrodynamic Shakers**  
Ivano La Paglia, Politecnico di Milano, Italy  
 Samanta Dallasta, Politecnico di Milano, Italy  
 Francesco Ripamonti, Politecnico di Milano, Italy  
 Gisella Tomasini, Politecnico di Milano, Italy  
 Carlo Tripodi, ASK Industries S.p.A., Italy  
 Roberto Corradi, Politecnico di Milano, Italy
- 11:20 Distributed Access by Multiple Sources for Age of Information Minimization Over a Finite Horizon**  
Emilija Đokanovic, University of Padova, Italy  
 Andrea Munari, German Aerospace Center (DLR), Germany  
 Leonardo Badia, University of Padova, Italy
- 11:40 A TSN-Based Approach to Combine Real-Time CAN Network With In-Vehicle Ethernet**  
 Alberto Morato, National Research Council - IEIIT, Italy  
 Elena Ferrari, University of Padova, Italy

Stefano Vitturi, National Research Council - IEIIT, Italy  
 Federico Tramarin, University of Modena and Reggio Emilia, Italy  
 Claudio Zunino, National Research Council - IEIIT, Italy  
 Manuel Cheminod, National Research Council - IEIIT, Italy

**12:00 Intelligent Electrical Assessment of Silicon and Silicon Carbide Wafers for Power Applications in Automotive Field**

Francesco Rundo, STMicroelectronics, Italy  
 Michele Calabretta, STMicroelectronics, Italy  
 Michael Rundo, University of Catania, Italy  
 Sebastiano Battiato, University of Catania, Italy  
 Angelo Alberto Messina, STMicroelectronics, Italy  
 Giulia Castagnolo, STMicroelectronics, Italy  
 Carmelo Pino, STMicroelectronics, Italy

12:20 - 13:40 *Palazzo Hercolani - Sala Boschereccia*  
**LUNCH**

13:40 - 14:40 *Palazzo Hercolani - Sala dei Poeti*  
**Session 2 - Vehicle Radar Sensors - Simulation, Testing, Measurement and Communication**  
**Chair: Jan Sobotka, Czech Technical University in Prague, Czech Republic**

**13:40 Low Latency Digital Radar Target Simulator Design**  
Jan Sobotka, Czech Technical University in Prague, Czech Republic  
 Viktor Adler, Czech Technical University in Prague, Czech Republic

**14:00 The Impact of Automotive Radar Configuration on Power Consumption: The Case of TI AWR1843**  
Gianluca Ciattaglia, Università Politecnica delle Marche, Italy  
 Adelmo De Santis, Università Politecnica delle Marche, Italy  
 Linda Senigagliesi, Università Politecnica delle Marche, Italy  
 Michela Raimondi, Università Politecnica delle Marche, Italy  
 Antonio Nocera, Università Politecnica delle Marche, Italy  
 Ennio Gambi, Università Politecnica delle Marche, Italy  
 Susanna Spinsante, Università Politecnica delle Marche, Italy

**14:20 Low PAPR OFDM Using SLM With Modified Riemann Matrix in JARC Systems**  
Didem Aydogan, Université Gustave Eiffel, France  
 Charles Tatkeu, Université Gustave Eiffel, France  
 Yassin Elhillali, Université Polytechnique Hauts-de-France, France

14:40 - 15:20

*Palazzo Hercolani - Sala dei Poeti*

**KEYNOTE SESSION**

**Chairs:** Marco Crescentini, *University of Bologna, Italy*

Federico Tramarin, *University of Modena and Reggio Emilia, Italy*

**E-motor testing: Tools and methodologies**

Salvatore Afeltra, Andrea Sangermano, *AVL*

15:20 - 15:45

*Palazzo Hercolani - Sala Boschereccia*

**COFFEE BREAK**

15:45 - 17:10

*Palazzo Hercolani - Sala dei Poeti*

**Military Metrology for Automotive**

**Chair:** B. Gen. Giovanni Savoldelli Pedrocchi, *Afcea Chapter Naples*

**15:45 Welcome Addresses**

B. Gen. Giovanni Savoldelli Pedrocchi, *President, Afcea Chapter Naples*

**15:50 Test engineering for product analysis and validation**

Eng. Federico Brunelli Garuti, *TEC EUROLAB*

**16:05 CEPOLISPE, a Centre for Innovation and Experimentation**

Ten. Lorenzo Mastrodicasa, *Italian Army*

**16:20 NVH (Noise Vibration and Harsness) measurements and instrumentation**

Eng. Michele Corso, Eng. Giovanni Rigosi, *MARPOSS - Special Applications Division*

**16:35 Test engineering for the automotive sector: functional pressure, mechanical and vibration tests on components in use**

Eng. Federico Brunelli Garuti, *TEC EUROLAB*

**16:50 ATHENA, Advanced Testing of Heterogeneous Electromagnetic Non-conventional Assets**

Ten. Lorenzo Mastrodicasa, *Italian Army*

**17:05 Closing remarks**

B. Gen. Giovanni Savoldelli Pedrocchi, *President, Afcea Chapter Naples*

17:10 - 18:30

*Palazzo Hercolani - Sala dei Poeti*

**Session 3 - Design, Characterization and Validation of Sensors and Measuring Systems for Autonomous Driving**

**Chair:** Davide Cassanelli, *University of Modena and Reggio Emilia, Italy*

**17:10 Enhancing Object Detection and Localization Through Multi-Sensor Fusion for Smart City Infrastructure**

Soujanya Syamal, *Cranfield University, United Kingdom*

Cheng Huang, *Cranfield University, United Kingdom*

Ivan Petrunin, *Cranfield University, United Kingdom*

- 17:30 Assessment and Benchmarking Approaches for 3D LiDAR Systems: A Comprehensive Overview**  
Davide Cassanelli, University of Modena and Reggio Emilia, Italy  
Stefano Cattini, University of Modena and Reggio Emilia, Italy  
Luigi Rovati, University of Modena and Reggio Emilia, Italy
- 17:50 Deep Learning for Risk Assessment in Automotive Applications**  
Francesco Rundo, STMicroelectronics, Italy  
Michele Calabretta, STMicroelectronics, Italy  
Michael Rundo, University of Catania, Italy  
Sebastiano Battiato, University of Catania, Italy  
Angelo Alberto Messina, STMicroelectronics, Italy  
Alessandro Sitta, STMicroelectronics, Italy
- 18:10 Use of Reinforcement Learning to Improve GNSS Satellites Signal Acquisition Search Strategy**  
Giovanni Gogliettino, STMicroelectronics, Italy  
Fabio Pisoni, STMicroelectronics, Italy  
Domenico Di Grazia, STMicroelectronics, Italy

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19:00 - 21:00 *Il Caffè della Corte Bistrot*  
**WELCOME PARTY**

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# Technical Program - Thursday, June 27

09:00 - 18:00 *Palazzo Hercolani*

## REGISTRATIONS

09:30 - 10:50 *Palazzo Hercolani - Sala dei Poeti*

### Session 4 - Measurement for Improving Quality, Reliability and Safety in Automotive Applications

**Chairs:** Lorenzo Ciani, *University of Florence, Italy*  
Gabriele Patrizi, *University of Florence, Italy*

**09:30 Verification and Validation (V&V) for Safe Deployment of Automated Driving Systems - in Depth Evaluation of State-Of-The-Art V&V Methods in the Automotive Sector**

Sebastian Siegl, Audi AG, Germany

Tobias Düser, Karlsruhe Institute of Technology, Institute of Product Engineering at KIT, Germany

**09:50 Enhancing Automotive Safety Through Advanced Object Behaviour Tracking for Intelligent Traffic and Transport Systems**

Chandni Saha, Cranfield University, United Kingdom  
Trung Hieu Tran, Cranfield University, United Kingdom  
Soujanya Syamal, Cranfield University, United Kingdom

**10:10 Characterization of LiFePO4 Cells for Formula SAE's Driverless Vehicle Using Climate Tests**

Gabriele Patrizi, University of Florence, Italy

Edoardo Pippi, University of Florence, Firenze Race Team, Italy  
Tiziano Fontanelli, University of Florence, Firenze Race Team, Italy  
Lorenzo Porcheddu, University of Florence, Firenze Race Team, Italy  
Marcantonio Catelani, University of Florence, Italy  
Lorenzo Ciani, University of Florence, Italy

**10:30 Air Pressure System Failures Detection Using LSTM-Autoencoder**

Mehmet Emin Mumcuoglu, Sabanci University, Turkey  
Shawqi Mohammed Othman Farea, Sabanci University, Turkey  
Mustafa Unel, Sabanci University, Turkey  
Serdar Mise, Ford OTOSAN, Turkey  
Simge Unsal, Ford OTOSAN, Turkey  
Enes Cevik, Ford OTOSAN, Turkey  
Metin Yilmaz, Ford OTOSAN, Turkey  
Kerem Köprübaşı, Ford OTOSAN, Turkey

10:50 - 11:20 *Palazzo Hercolani - Sala Boschereccia*  
**COFFEE BREAK**

11:20 - 13:00 *Palazzo Hercolani - Sala dei Poeti*  
**Session 5 - The Smart Battery Cell: Sensors, Modeling, Diagnostics and Characterization for the Next Generation Batteries**  
**Chairs:** Valentina Bianchi, *University of Parma, Italy*  
 Roberta Ramilli, *University of Bologna, Italy*

**11:20 Pre-Compliance Vibration Testing of a LFP Battery Pack Prototype for Electric Powertrains**

Hadi Eidinejad, University of Bologna, Italy  
 Francesco Madaro, University of Bologna, Italy  
 Tommaso Brugo, University of Bologna, Italy  
 Claudio Rossi, University of Bologna, Italy  
 Alessandro Rivola, University of Bologna, Italy  
 Marco Troncossi, University of Bologna, Italy  
 Alberto Martini, University of Bologna, Italy

**11:40 An Optimized Long Short Term Memory and Gaussian Process Regression Based Framework for State of Charge Estimation**

Sadia Ali, University of Parma, Italy  
 Mattia Stighezza, University of Parma, Italy  
 Giovanni Chiorboli, University of Parma, Italy  
 Ilaria De Munari, University of Parma, Italy  
 Valentina Bianchi, University of Parma, Italy

**12:00 FPGA Implementation of Support Vector Regression for Battery SoC Estimation**

Gianfranco Lombardi, University of Parma, Italy  
 Mattia Stighezza, University of Parma, Italy  
 Ilaria De Munari, University of Parma, Italy  
 Valentina Bianchi, University of Parma, Italy

**12:20 Characterization of Uncertainty in EIS and DRT Analysis of Lithium Batteries**

Alessio De Angelis, University of Perugia, Italy  
 Antonio Bertei, University of Pisa, Italy  
Paolo Carbone, University of Perugia, Italy

**12:40 A Low-Cost Electrochemical Impedance Spectroscopy-Based Sensor Node for Online Battery Cell Monitoring**

Morena Fabozzi, University of Bologna, Italy  
Roberta Ramilli, University of Bologna, Italy  
 Marco Crescentini, University of Bologna, Italy  
 Pier Andrea Traverso, University of Bologna, Italy

13:00 - 14:20 *Palazzo Hercolani - Sala Boschereccia*  
**LUNCH**



14:20 - 15:10

Palazzo Hercolani - Sala dei Poeti

**KEYNOTE SESSION**

**Chairs:** Marco Crescentini, *University of Bologna, Italy*

Federico Tramarin, *University of Modena and Reggio Emilia, Italy*

**Use of optical surface temperature measurement on high speed turbine to optimize engine efficiency**

Silvio Rabbolini, *Ferrari*

15:10 - 16:50

Palazzo Hercolani - Sala dei Poeti

**Session 6 - Smart Metering for e-Mobility and Charging Infrastructure**

**Chair:** Antonio Delle Femine, *University of Campania "Luigi Vanvitelli", Italy*

**15:10 Metrology for Electric Vehicle Charging Systems: An Overview of the European Research Project**

Antonio Delle Femine, University of Campania Luigi Vanvitelli, Italy

Claudio Iodice, University of Campania Luigi Vanvitelli, Italy

Jan Kučera, Czech Metrology Institute, Czech Republic

Erik Dierikx, VSL, The Netherlands

Andrea Mariscotti, University of Genova, Italy

Javier Díaz de Aguilar, CEM, Spain

Iván Higuero Torres, ITE, Spain

Thijs Van Wijk, ElaadNL, The Netherlands

**15:30 Development of a Sensor System for Load Monitoring in the Electrical Grid to Support e-Mobility Charging**

Felix Essingholt, Fraunhofer IMS, Germany

Linda Cousin, Fraunhofer IMS, Germany

Gerd vom Bögel, Fraunhofer IMS, Germany

Thorben Greuter, Fraunhofer IMS, Germany

Anton Grabmaier, University of Duisburg, Germany

**15:50 EVSE Metrological Verification Through IEC 61851 Protocol Hacking**

Antonio Delle Femine, University of Campania Luigi Vanvitelli, Italy

Daniele Gallo, University of Campania Luigi Vanvitelli, Italy

Claudio Iodice, University of Campania Luigi Vanvitelli, Italy

Carmine Landi, University of Campania Luigi Vanvitelli, Italy

Mario Luiso, University of Campania Luigi Vanvitelli, Italy

**16:10 Optimal Power-Line-Filter Desing for Three-Phase Electric-Vehicle Charging Stations**

Marco Bosi, University of Bologna, Italy

Mattia Simonazzi, University of Bologna, Italy

Lorenzo Peretto, University of Bologna, Italy

Leonardo Sandrolini, University of Bologna, Italy

**16:30 ICT-Equipped Portable E-Bike Charging Station Powered by Renewables for Mass Cycling Events**

Davide Astolfi, University of Brescia, Italy  
 Paolo Bellagente, University of Brescia, Italy  
 Dennis Brandão, University of Brescia, Italy  
 Salvatore Dello Iacono, University of Brescia, Italy  
 Alessandro Depari, University of Brescia, Italy  
 Paolo Ferrari, University of Brescia, Italy  
Alessandra Flammini, University of Brescia, Italy  
 Massimiliano Gaffurini, University of Brescia, Italy  
 Marco Pasetti, University of Brescia, Italy  
 Stefano Rinaldi, University of Brescia, Italy  
 Emiliano Sisinni, University of Brescia, Italy  
 Antony Vasile, University of Brescia, Italy

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16:50 - 17:20 *Palazzo Hercolani - Sala Boschereccia*  
**COFFEE BREAK**

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17:20 - 18:00 *Palazzo Hercolani - Sala dei Poeti*  
**IEEE WiE Italy Section AG - Exploiting the gender diversity impact in the Automotive sector**  
**Chair:** Roberta Di Pace, *University of Salerno, Italy*

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19:45 *"Da Cesari" Restaurant*  
**GALA DINNER**

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# Technical Program - Friday, June 28

09:00 - 12:00 *Palazzo Hercolani*  
**REGISTRATIONS**

09:30 - 10:20 *Palazzo Hercolani - Sala dei Poeti*  
**KEYNOTE SESSION**  
**Chair:** Stefano Cattini, *University of Modena and Reggio Emilia, Italy*

## **Satellite Modernization, Precise Positioning and Sensor Fusion: Unlocking the Full Potential of GNSS in Automotive Applications**

*Domenico Di Grazia, STMicroelectronics*

10:20 - 10:50 *Palazzo Hercolani - Sala Boschereccia*  
**COFFEE BREAK**

10:50 - 12:30 *Palazzo Hercolani - Sala dei Poeti*  
**Session 7 - Sensors, systems and methods for measuring driver performance and interaction with the vehicle**  
**Chairs:** Antonio Affanni, *University of Udine, Italy*  
Susanna Spinsante, *Università Politecnica delle Marche, Italy*  
Andrea Amidei, *University of Modena and Reggio Emilia, Italy*

### **10:50 Operational Transfer Path Analysis for the Investigation of Structure-Borne Noise Paths of a Vehicle**

Samanta Dallasta, *Politecnico di Milano, Italy*  
Ivano La Paglia, Politecnico di Milano, Italy  
Luca Rapino, *Politecnico di Milano, Pirelli Tyre S.p.A., Italy*  
Francesco Ripamonti, *Politecnico di Milano, Italy*  
Simone Baro, *Pirelli Tyre S.p.A., Italy*  
Roberto Corradi, *Politecnico di Milano, Italy*

### **11:10 Design and Realization of a Wearable Necklace for the Assessment of Driver Well-Being Through Heart Rate and Blood Oxygen Saturation Monitoring**

Antonio Affanni, University of Udine, Italy  
Roberto Rinaldo, *University of Udine, Italy*

**11:30 An Innovative System for Driver Monitoring and Vehicle Sound Interaction**

Andrea Generosi, Università Politecnica Delle Marche, Italy  
 Valeria Bruschi, Università Politecnica Delle Marche, Italy  
 Stefania Cecchi, Università Politecnica Delle Marche, Italy  
 Nefeli Aikaterini Dourou, Università Politecnica Delle Marche, Italy  
 Roberto Montanari, Re-Lab Srl, Italy  
 Maura Mengoni, Università Politecnica Delle Marche, Italy

**11:50 Skin Conductance Response in Real Driving Settings: Comparison of Analysis Methods**

Grazia Iadarola, Università Politecnica Delle Marche, Italy  
 Susanna Spinsante, Università Politecnica Delle Marche, Italy

**12:10 Preliminary Analysis of Sensor Fusion Dataset for Cyclists' Gesture Recognition**

Stefano Rinaldi, University of Brescia, Italy  
Salvatore Dello Iacono, University of Brescia, Italy  
 Marco Pasetti, University of Brescia, Italy  
 Davide Astolfi, University of Brescia, Italy  
 Dennis Brandão, University of Brescia, Italy  
 Alessandra Flammini, University of Brescia, Italy  
 Paolo Ferrari, University of Brescia, Italy  
 Emiliano Sisinni, University of Brescia, Italy

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12:30 - 13:50 *Palazzo Hercolani - Sala Boschereccia*  
**LUNCH**

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13:50 - 14:30 *Palazzo Hercolani - Sala dei Poeti*  
**KEYNOTE SESSION**  
**Chair:** Pier Andrea Traverso, *University of Bologna, Italy*

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**Characterization of lithium batteries for automotive applications: from laboratory testing to field data collection**

Mirko Marracci, *University of Pisa*

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14:30 - 15:30 *Palazzo Hercolani - Sala dei Poeti*  
**CLOSING AND AWARD CEREMONY**

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