2023 IEEE INTERNATIONAL WORKSHOP ON

Metrology for Automotive

Modena, Italy / June 28-30, 2023

Metro Automotive
Modena 2023

WORKSHOP
PROGRAM

www.**metroautomotive**.org

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 2023 IEEE International Workshop on Metrology for Automotive (MetroAutomotive). We are very proud to announce that this 3rd edition of the Workshop will be held at the beautiful venue of the Palazzo Ducale of Modena, home of the Accademia Militare of Italy.

The first two editions of this workshop represented a starting point to build up a growing community around the role of instrumentation, sensing, and measurement technologies in the field of Automotive. The success of the first edition, which was launched in 2021 in a virtual format due to the global lockdown and travel restrictions, the Organizing Committee strongly supported and worked hard towards a fully-in-person event, that culminated last year in MetroAutomotive 2022, located in Modena at the heart of the Italian Motorvalley.

The most genuine intention is to encourage a return to face-to-face events, and as such the goal of this 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 IEEE MetroAutomotive 2023 Technical Program consists of 2 keynotes, 10 technical sessions, and a brand-new panel session focused on military automotive measurements. The Workshop is scheduled over three days, aiming to cover the several 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 received proposals for 11 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 in the field of measurements for automotive:

- o Salvatore Afeltra, from AVL, will present: *A cutting edge H2 measurement system for automotive applications: AVL Hytron*
- o Gennaro Monacelli, from CNH Industrial, will present: *Dynamic Drive in the Loop simulator for off road vehicles: how to enhance the v-cycle in the product development process*

As in the previous editions, the IEEE MetroAutomotive 2023 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 presentations, will be followed by live Q&A. All accepted papers will be published in the workshop proceedings, while presented papers adhering to 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 all the Technical Program Committee and International Program Committee members and the reviewers who have contributed to making this possible.

We all did our best for the success of this new 3rd edition of MetroAutomotive 2023, 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
Luigi Rovati, University of Modena and Reggio Emilia, Italy
Lorenzo Peretto, University of Bologna, Italy

IEEE MetroAutomotive 2023 Committee

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Michele Pinelli, University of Ferrara, Italy
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IEEE MetroAutomotive 2023 Venue

IEEE MetroAutomotive 2023 will be held at the
Palazzo Ducale of Modena – *Piazza Roma, 15*

The current Palace stands on the site that was once occupied by the castle erected in 1291 by Obizzo d'Este, Marquis of Ferrara. This is where the various canals of Modena, that flow from the south toward the Po river, converged and joined forming the moat of the fortress, finally emerging united from the rear, along what is now Viale Vittorio Emanuele II.
The elegant facade has three flanking window plans, crowned by balustrades with statues. The central and side parts are elevated. The Cortile d'Onore, with an elegant two-story loggia, is a masterpiece of Baroque architecture. From here one enters the Scalone d'Onore adorned with Roman statues, which leads to the Loggia and the numerous rooms of the State Apartment.
Today, the prestigious Modena Military Academy is based here.

ADDRESS
Piazza Roma, 15
Modena

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

IEEE MetroAutomotive 2023 Social Events

WELCOME PARTY
Wednesday June 28 - H 18:45

The Welcome Party will be held at the *Palazzo Ducale di Modena* – Piazza Roma, 15 on **Wednesday, June 28** - 18.45.

ADDRESS
Piazza Roma 15
Modena

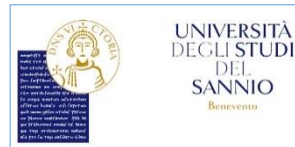## GALA DINNER
Thursday June 29 - H 20:00

The Gala Dinner will be held at "*Agriturismo Lambruscheria Ca'Berti*" on **Thursday, June 29** - 20.00. A shuttle bus will be available for the Conference Attendees.

ADDRESS
Via Spagna 60
Castelvetro Di Modena

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Program Schedule - Wednesday, June 28

WEDNESDAY - JUNE 28, 2023		
14:00 - 14:30	Opening Ceremony - Welcome Addresses	
14:30 - 16:10	Session 1.1 - Thermal and fluid dynamic measurement for automotive powertrain and vehicles development, control and monitoring	Session 1.2 - Battery Cells and Battery systems modeling, design, monitoring and diagnostics
16:10 - 16:30	Coffee Break	
16:30 - 18:40	Military Metrology for Automotive	
18:45 - 20:30	Welcome Party	

Program Schedule - Thursday, June 29

THURSDAY - JUNE 29, 2023		
09:30 - 11:10	Session 2.1 - Measurement for Improving Quality, Reliability and Safety in Automotive Applications	Session 2.2 - Towards Smart and Secure Solutions for Future e-Mobility
11:10 - 11:40	Coffee Break	
11:40 - 12:40	Keynote Speaker #1 - Salvatore Afeltra, AVL A cutting edge H2 measurement system for automotive applications: AVL Hytron	
12:40 - 14:20	Lunch	
14:20 - 15:20	Women in Engineering - Italy Section AG - Panel	
15:20 - 17:00	Session 3.1 - Multiband GNSS Observables, Inertial Sensor Fusion and Advanced Receiver Algorithms for Autonomous Navigation	Session 3.2 - Session 3.2 - Smart Metering for E-Mobility and sustainability of the distribution grid
19:30 - 23:30	Gala Dinner	

Program Schedule - Friday, June 30

FRIDAY - JUNE 30, 2023		
09:30 - 11:10	Session 4.1 - General Session - Part I	Session 4.2 - General Session - Part II
11:10 - 11:40	Coffee Break	
11:40 - 12:40	Keynote Speaker #2 - Gennaro Monacelli, CNH Industrial Dynamic Drive in the Loop simulator for off road vehicles: how to enhance the v-cycle in the product development process	
12:40 - 14:20	Lunch	
14:20 - 15:40	Session 5.1 - General Session - Part III	Session 5.2 - Metrology for environmental perception sensors and systems in intelligent transportation & vehicles
15:40 - 16:00	Closing and Award Ceremony	

Technical Program - Wednesday, June 28

14:00 - 18:00	*Palazzo Ducale di Modena* **REGISTRATIONS**

14:00 - 14:30	*Palazzo Ducale - Aula Magna* **OPENING CEREMONY - WELCOME ADDRESSES**

14:30 - 16:10	*Palazzo Ducale - Aula Magna* **Session 1.1 - Thermal and fluid dynamic measurement for automotive powertrain and vehicles development, control and monitoring** **Chairs**: Carlo Alberto Rinaldini, *University of Modena and Reggio Emilia* Giuseppe Cantore, *University of Modena and Reggio Emilia*

14:30   **An Enhanced Light Gradient Boosting Regressor for Virtual Sensing of CO, HC and NOx**
Emanuele Giovannardi, University of Bologna, Italy
Alessandro Brusa, University of Bologna, Italy
Boris Petrone, University of Bologna, Italy
Nicolò Cavina, University of Bologna, Italy
Enrico Corti, University of Bologna, Italy
Massimo Barichello, Ferrari S.p.A., Italy

14:50   **Review of the Last Draft Requirements of the Euro 7 Emissions Standard and Their Impact on Light-Duty Car Manufacturers**
Andrea Forte, MOTONICA SRL, Italy

15:10   **Experimental Testing of a Heavy-Duty Diesel Engine at the Dynamic Test Bench to Assess the Potential of Regenerative Braking**
Andrea Altomonte, University of Naples Parthenope, Italy
Emmanuele Frasci, University of Naples Parthenope, Italy
Giovanni Di Ilio, University of Naples Parthenope, Italy
Ivan Arsie, University of Naples Parthenope, Italy
Elio Jannelli, University of Naples Parthenope, Italy

15:30   **Study of Particulate Matter Formation at High-Performance Engines Using In-Cylinder Optical and Fast Exhaust Gas Sampling Techniques**
Ioannis Kitsopanidis, Ferrari S.p.A., Italy
Federico Gioachini, Ferrari S.p.A., Italy

Roberto Mariconti, Ferrari S.p.A., Italy
Harald Philipp, AVL List GmbH, Austria
Marco Iorfino, AVL Italy Srl, Italy

15:50   **Digital Twins in 'off-Highway Vehicles' Product Development Will Help the Green Transition**
Gennaro Monacelli, CNH Industrial, Italy
Carlo De Marco, CNH Industrial, Italy

14:30 - 16:10   *Palazzo Ducale - Aula 1*
Session 1.2 - Battery Cells and Battery systems modeling, design, monitoring and diagnostics
Chairs: Valentina Bianchi, University of Parma, Italy
           Marco Crescentini, University of Bologna, Italy

14:30   **Machine Learning and Impedance Spectroscopy for Battery State of Charge Evaluation**
Mattia Stighezza, University of Parma, Italy
Roberto Ferrero, University of Liverpool, United Kingdom
Valentina Bianchi, University of Parma, Italy
Ilaria De Munari, University of Parma, Italy

14:50   **Time-Domain Battery State-Of-Charge Estimation Based on Domain-Transformation and Linear Discriminant Analysis**
Paolo Carbone, University of Perugia, Italy
Alessio De Angelis, University of Perugia, Italy
Emanuele Buchicchio, University of Perugia, Italy
Francesco Santoni, University of Perugia, Italy
Antonio Moschitta, University of Perugia, Italy

15:10   **An Analytical Model for Lithium-Ion Batteries Based on Genetic Programming Approach**
Filippo Milano, University of Cassino and Southern Lazio, Italy
Giulia Di Capua, University of Cassino and Southern Lazio, Italy
Nunzio Oliva, EXELING Srl, University of Salerno, Italy
Francesco Porpora, University of Cassino and South Lazio, E-LECTRA, Italy
Carmine Bourelly, University of Cassino and Southern Lazio, Italy
Luigi Ferrigno, University of Cassino and Southern Lazio, Italy
Marco Laracca, Sapienza University of Rome, Italy

15:30   **Development of a Numerical Framework for the Analysis of a Multi-Tone EIS Measurement System**
Nicola Lowenthal, University of Bologna, Italy
Roberta Ramilli, University of Bologna, Italy
Marco Crescentini, University of Bologna, Italy
Pier Andrea Traverso, University of Bologna, Italy

15:50 **An RFID System Enabling Battery Lifecycle Traceability**
Gabriele Bandini, University of Pisa, Italy
Alice Buffi, University of Pisa, Italy
Gianluca Caposciutti, University of Pisa, Italy
Mirko Marracci, University of Pisa, Italy
Bernardo Tellini, University of Pisa, Italy

16:10 - 16:30	*Palazzo Ducale di Modena*
	COFFEE BREAK

16:30 - 18:30	*Palazzo Ducale - Aula Magna*
	Military Metrology for Automotive
	Chair: B.Gen. Giovanni Savoldelli Pedrocchi, AFCEA Chapter Naples

16:30 **Welcome Adresses**
B.Gen. Giovanni Savoldelli Pedrocchi, *President, AFCEA Chapter Naples*

16:35 **Measurement of endurance and handling performance of military vehicles**
Capt. Alessio Pizzi, *Italian Army*

16:55 **Quality control for E-Motors components**
Eng. Michele Corso, *MARPOSS, Special Applications Division*

17:15 **Industrial Tomography: Revolutionizing Metrological Precision and Defect Detection Across Industries**
Eng. Fabio Esposito, *R&D Manager of TEC Eurolab*

17:35 **Global Performance Oriented Design**
Eng. Davide Seletti, *CEO DALLARA Compositi*

17:55 **Metrology of military Electro-Magnetic Compatibility Test & Evaluation: a system level perspective**
LTen. Alberto Matta, *Italian Army*

18:15 **Oral Engineering Innovative All Terrain Vehicle 2WD - 4WD – design and testing (PNRM # a2018.152)**
Franco Antoniazzi e Marco Demurtas, *Oral Engineering Srl*

18:35 **Closing Remarks**
B.Gen. Giovanni Savoldelli Pedrocchi

18:45 - 20:30	*Palazzo Ducale di Modena*
	WELCOME PARTY

Technical Program - Thursday, June 29

09:00 - 17:00	*Palazzo Ducale di Modena* **REGISTRATIONS**

09:30 - 11:10	*Palazzo Ducale - Aula Magna* **Session 2.1 - 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 **Exponential Degradation Model for Remaining Useful Life Estimation of Electrolytic Capacitors**
Gabriele Patrizi, University of Florence, Italy
Lorenzo Ciani, University of Florence, Italy
Marcantonio Catelani, University of Florence, Italy

09:50 **Challenges in Designing Measurement Systems for Formula One Cars**
Przemyslaw Wojciechowski, Military University of Technology, Poland
Konrad Wojtowicz, Military University of Technology, Poland

10:10 **TinyML for Safe Driving: The Use of Embedded Machine Learning for Detecting Driver Distraction**
Thommas Kevin Sales Flores, Federal University of Rio Grande do Norte, Brazil
Marianne Silva, Federal University of Rio Grande do Norte, Brazil
Mariana Azevedo, Federal University of Rio Grande do Norte, Brazil
Thaís Medeiros, Federal University of Rio Grande do Norte, Brazil
Morsinaldo Medeiros, Federal University of Rio Grande do Norte, Brazil
Ivanovitch Silva, Federal University of Rio Grande do Norte, Brazil
Max Mauro Dias Santos, Federal University of Technology, Brazil
Daniel G. Costa, University of Porto, Portugal

10:30 **Conducted Emission and Power Line Filter Design of a Three-Phase Grid-Connected Battery Charger for Automotive Application**
Marco Bosi, University of Bologna, Italy
Mattia Simonazzi, University of Bologna, Italy
Lorenzo Peretto, University of Bologna, Italy
Leonardo Sandrolini, University of Bologna, Italy

10:50 **Optimization of Automotive Software Tests by Simplification of the Bus Simulation**
Rudolf Keil, Volkswagen AG, Germany
Jan Alexander Tschorn, Volkswagen AG, Germany

Johannes Tümler, Anhalt University of Applied Sciences, Germany
M. Ercan Altinsoy, Dresden University of Technology, Germany

Session 2.2 - Towards Smart and Secure Solutions for Future e-Mobility
Chair: Gian Piero Gibiino, University of Bologna, Italy

09:30 **Digitization of the Distribution Grid to Support e-Mobility Charging Infrastructure**
Gerd vom Bögel, Fraunhofer IMS, Germany
Felix Essingholt, Fraunhofer IMS, Germany
Bernhard Bennertz, Fraunhofer IMS, Germany
Thorben Grenter, Fraunhofer IMS, Germany

09:50 **Design of a Novel Pulser for Frequency Selective-Based Power and Data Transmission**
Stefano Taccetti, University of Bologna, Italy
Lorenzo Mistral Peppi, University of Bologna, Italy
Federica Zonzini, University of Bologna, Italy
Masoud Mohammadgholiha, University of Bologna, Italy
Matteo Zauli, University of Bologna, Italy
Luca De Marchi, University of Bologna, Italy

10:10 **A Low Power NFC Data Over Power Acquisition System for High Speed Electric Motor Rotors**
Mariano Nerone, HPE Group, Italy
Igor Valič, HPE Group, Italy
Matteo Zauli, University of Bologna, Italy
Nicola Matteazzi, HPE Group, Italy
Luca De Marchi, University of Bologna, Italy

10:30 **Automated Measurement Set-Up for the Electro-Mechanical Characterization of Piezoelectric Harvesters**
Nicola Lowenthal, University of Bologna, Italy
Gian Piero Gibiino, University of Bologna, Italy
Cinzia Tamburini, University of Bologna, Italy
Mattia Mengozzi, University of Bologna, Italy
Aldo Romani, University of Bologna, Italy
Marco Crescentini, University of Bologna, Italy
Pier Andrea Traverso, University of Bologna, Italy

10:50 **Temperature Sensors Virtualization in High Performance Electric Motors**
Andrea Zanellini, HPE Group, Italy
Stefano Pellegrini, HPE Group, Italy
Mariano Nerone, HPE Group, Italy
Igor Valič, HPE Group, Italy
Matteo Zauli, University of Bologna, Italy
Luca De Marchi, University of Bologna, Italy
Nicola Matteazzi, HPE Group, Italy

Mattia Violi, HPE Group, Italy
Riccardo Rovatti, University of Bologna, Italy

11:10 - 11:40	*Palazzo Ducale di Modena*
	COFFEE BREAK

11:40 - 12:40	*Palazzo Ducale - Aula Magna*
	PLENARY SESSION - KEYNOTE SPEAKER
	Chair: Pier Andrea Traverso, *University of Bologna, Italy*

A cutting edge H2 measurement system
for automotive applications: AVL Hytron

Salvatore Afeltra, *Sales Engineer - AVL*

The use of hydrogen (H2) or compressed natural gas as an energy carrier plays a major role in decarbonizing our mobility and transportation on a global scale. With decades of experience and leadership in the consumption measurement of conventional liquid fuels, we have added another industrialized solution to the the AVL portfolio for testbed applications: AVL Hytron .

12:40 - 14:20	*Palazzo Ducale di Modena*
	LUNCH

14:20 - 15:20	*Palazzo Ducale - Aula Magna*
	IEEE WiE ITALY SECTION AG - PANEL
	Chair: Lisa Tondelli, *University of Modena and Reggio Emilia, Italy*

Exploiting the gender diversity impact in the Automotive sector
with a Special Focus on Metrology for Automotive

The event aims to bring into light the impact of gender diversity in the Automotive sector and encourage discussion around how gender-based differences should be taken into account and can be transformed into a value.
During the session, the WIE Commitment Chart "Steering girls to STEM" will be presented. A particular focus will be given to point 8 of the commitment chart: "demonstration of the advantages derived from female presence in working realities", and how it relates to the Automotive Sector. To this aim, the speakers from Industry will bring their views on gender diversity impact in the Automotive sector.

14:30 - 14:40
IEEE WIE Italy Section Affinity Group - Patrizia Lamberti, *University of Salerno*

14:40 - 15:00
Invited Speaker - Ilaria De Munari, *University of Parma*

15:00 - 15:15 - ROUND TABLE
Lisa Tondelli, *University of Modena and Reggio Emilia*
Ilaria De Munari, *University of Parma*
Manula Tufo, *Kineton Srl - R&D director*

15:15 - 15:20
Conclusions - Roberta di Pace, *University of Salerno*

15:20 - 17:00   *Palazzo Ducale - Aula Magna*
                    Session 3.1 - Multiband GNSS Observables, Inertial Sensor Fusion and Advanced Receiver Algorithms for Autonomous Navigation
                    Chairs: Domenico Di Grazia, *STMicroelectronics, Italy*
                              Fabio Pisoni, *STMicroelectronics, Italy*

15:20   Long GNSS Secondary Codes Acquisition by Characteristic Length Method
            Domenico Di Grazia, STMicroelectronics, Italy
            Fabio Pisoni, STMicroelectronics, Italy
            Salvatore Crasta, STMicroelectronics, Italy
            Antonio Napolitano, Parthenope University of Naples, Italy
            Donatella Darsena, University of Naples Federico II, Italy
            Simone Ardiero, STMicroelectronics, Italy

15:40   A Loosely Coupled Architecture for INS/GNSS Integration With Tracking Loops Aiding
            Fabio Pisoni, STMicroelectronics, Italy
            Domenico Di Grazia, STMicroelectronics, Italy
            Giovanni Gogliettino, STMicroelectronics, Italy
            Nicola Palella, STMicroelectronics, Italy
            Leonardo Colombo, STMicroelectronics, Italy

16:00   Demonstrating Galileo HAS in Single Point Positioning
            Giovanni Cappello, Parthenope University of Naples, Italy
            Antonio Angrisano, University of Messina, Italy
            Silvia Ascione, Parthenope University of Naples, Italy
            Silvio Del Pizzo, Parthenope University of Naples, Italy
            Ciro Gioia, Independert Researcher
            Gabriele Portelli, Parthenope University of Naples, Italy
            Melania Susi, Joint Research Centre
            Salvatore Gaglione, Parthenope University of Naples, Italy

16:20 **Galileo High Accuracy Service: An Automotive Test**
Luca Cucchi, Joint Research Centre European Commission, Italy
Ciro Gioia, Independert Researcher
Tommaso Senni, Joint Research Centre European Commission, Italy
Matteo Paonni, Joint Research Centre European Commission, Italy

16:40 **GNSS Threat Identification and Mitigation, Cyber-Security Aspects in Automotive Scenarios**
Carmine Gianni, CY4GATE S.p.A., Italy
Rosario Giordano, CY4GATE S.p.A., Italy
Gregorio Pitolli, CY4GATE S.p.A., Italy
Graziano Lubello, CY4GATE S.p.A., Italy

15:20 - 16:20 *Palazzo Ducale - Aula 1*
Session 3.2 - Smart Metering for E-Mobility and sustainability of the distribution grid
Chairs: Mario Luiso, *University of Campania "L. Vanvitelli", Italy*
Marco Pasetti, *University of Brescia, Italy*

15:20 **On-Field Metrological Verification of EVSE**
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

15:40 **Design of an ICT Platform for a Sustainable Charging of Light Electric Vehicles Using Renewable Resources**
Stefano Rinaldi, University of Brescia, Italy
Paolo Bellagente, University of Brescia, Italy
Paolo Ferrari, University of Brescia, Italy
Alessandra Flammini, University of Brescia, Italy
Marco Pasetti, University of Brescia, Italy
Emiliano Sisinni, University of Brescia, Italy

16:00 **Metrological Characterization of EV Power Train Efficiency**
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

19:30 - 23:30 *Agriturismo Lambruscheria Ca'Berti*
GALA DINNER

Technical Program - Friday, June 30

09:00 - 12:00	*Palazzo Ducale di Modena* **REGISTRATIONS**

09:30 - 11:10	*Palazzo Ducale - Aula Magna* **Session 4.1 - General Session - Part I** **Chairs**: Consolatina Liguori, *University of Salerno, Italy* Paolo Sommella, *University of Salerno, Italy*

09:30   **Measurement and Evaluation of Vibration Exposure in Automotive Workplace**
Paolo Caruso, University of Salerno, Italy
Matteo Ferro, AcusticLab SRL, University of Salerno, Italy
Vincenzo Paciello, University of Salerno, Italy
Alessandro Ruggiero, University of Salerno, Italy
Domenico Russo, Metering Research srl, Italy

09:50   **Frequency Analysis for the Measurement of Environmental Noise**
Maria Lamberti, Metering Research srl, Italy
Consolatina Liguori, University of Salerno, Italy
Alessandro Ruggiero, University of Salerno, Italy
Domenico Russo, Metering Research srl, Italy
Paolo Sommella, University of Salerno, Italy

10:10   **Characterization of Green Materials for Automotive Acoustic Comfort**
Claudio Guarnaccia, University of Salerno, Italy
Alessandro Ruggiero, University of Salerno, Italy
Domenico Russo, Metering Research srl, Italy
Matteo Ferro, AcusticLab SRL, University of Salerno, Italy
Salvatore Dello Iacono, University of Brescia, Italy
Petr Valášek, Czech University of Life Sciences Prague, Czech Republic

10:30   **AUTOSAR in the Smart Cities Era: Current Developments and Research Trends**
Gonçalo M. d. Santos, University of Porto, Portugal
Daniel G. Costa, University of Porto, Portugal

10:50   **Sub-clock Digital Delay for Radar Target Simulation**
Jan Sobotka, Czech Technical University in Prague, Czech Republic
Viktor Adler, Czech Technical University in Prague, Czech Republic
Jiří Novák, Czech Technical University in Prague, Czech Republic

09:30 - 11:10	*Palazzo Ducale - Aula 1*
	Session 4.2 - General Session - Part II
	Chair: Mattia Bruschetta, *University of Padova, Italy*

09:30 **Motorcycle Longitudinal and Lateral State Estimation via Kalman Filtering**
Luca Caiaffa, University of Padova, Italy
Fabio Maran, Piaggio and C. Spa, Italy
Stivi Peron, Piaggio and C. Spa, Italy
Mattia Bruschetta, University of Padova, Italy

09:50 **Computer Vision Approaches for Vehicle Sideslip Angle Estimation**
Leonardo Serena, University of Padova, Italy
Basilio Lenzo, University of Padova, Italy
Mattia Bruschetta, University of Padova, Italy
Ricardo De Castro, University of California at Merced, USA

10:10 **A Strain-Based Estimation of Tire-Road Forces Through a Supervised Learning Approach**
Ciro Tordela, University of Naples Federico II, Italy
Salvatore Strano, University of Naples Federico II, Italy
Mario Terzo, University of Naples Federico II, Italy
Raffaele Marotta, University of Naples Federico II, Italy

10:30 **Deep Learning for the Estimation of the Longitudinal Slip Ratio**
Raffaele Marotta, University of Naples Federico II, Italy
Valentin Ivanov, Technische Universität Ilmenau, Germany
Salvatore Strano, University of Naples Federico II, Italy
Mario Terzo, University of Naples Federico II, Italy
Ciro Tordela, University of Naples Federico II, Italy

10:50 **An Adaptive TinyML Unsupervised Online Learning Algorithm for Driver Behavior Analysis**
Marianne Silva, Federal University of Rio Grande do Norte, Brazil
Thaís Medeiros, Federal University of Rio Grande do Norte, Brazil
Mariana Azevedo, Federal University of Rio Grande do Norte, Brazil
Morsinaldo Medeiros, Federal University of Rio Grande do Norte, Brazil
Mikael Themoteo, Federal University of Rio Grande do Norte, Brazil
Tatiane Gois, Federal University of Rio Grande do Norte, Brazil
Ivanovitch Silva, Federal University of Rio Grande do Norte, Brazil
Daniel G. Costa, University of Porto, Portugal

| 11:10 - 11:40 | *Palazzo Ducale di Modena* |
| | **COFFEE BREAK** |

11:40 - 12:40	*Palazzo Ducale - Aula Magna*
	PLENARY SESSION - KEYNOTE SPEAKER
	Chair: Federico Tramarin, *University of Modena and Reggio Emilia, Italy*

Dynamic Drive in the Loop simulator for off road vehicles: how to enhance the v-cycle in the product development process

Gennaro Monacelli, *CNH Industrial, Italy*

In October 2022 CNHi presented the Dynamic Driver-in-the loop Simulator that enhances the validation of off highway machinery achieving a design faster, more sustainable and more efficient. With this technology we achieved a great goal: to bring the driver into the design loop. The new Dynamic Simulator combines the subjective experience of the driver in physical tests with the objectivity of the data generated by numerical simulations. It can be used by various functions such as brands and marketing, up to dealers and special customers, for a design defined as "man in the loop". That is, the customer is placed at the center of the design of new products being able to interact already in the preliminary stages with the tractor and long before the actual launch on the market.

The improvement in the fidelity of the test driver's perceptions on board the simulator is achieved thanks to the MCA - Motion Cueing Algorithm technology which generates commands for the platform, aligning the operator's perceptions with those of the real vehicle, always considering the physical limits of the dynamic platform. The new product design process is based on the MBD - Model Based Development, capable of drastically reducing the number of prototypes - inevitably destined for landfill - needed to reach the market. The models used by the simulator are the heart of the system and form part of the specific know-how of CNH Industrial.

Unlike the other simulators, this one has been designed to house a new generation real cab weighing about 1 ton. Underneath, an electro-actuated hexapod system allows 6 degrees of freedom to the cab.

Subjectively verifying the behavior of new tractors or parts of them even before they are built is the first great advantage. This reduces work times for development reducing the needs of physical prototypes, reducing costs and consumption of raw materials, eliminating fuel consumption and emissions.

12:40 - 14:20	*Palazzo Ducale di Modena*
	LUNCH

14:20 **Over-The-Air Automotive Radars Hardware-In-Loop Test for Development and Validation of Active Safety Systems and Autonomous Cars**
Mokrane Hadj-Bachir, ESI-Group France, France
Toktam Bagheri, UniqueSec AB, Sweden
Henrik Toss, RISE Research Institutes of Sweden, Sweden
Philippe De Souza, ESI-Group France, France
Martin Sanfridson, RISE Research Institutes of Sweden, Sweden

14:40 **A Simple Setup for the Experimental Verification of Measurement Artifacts Introduced by 3D-LiDAR in In-Motion Acquisitions**
Davide Cassanelli, University of Modena and Reggio Emilia, Italy
Stefano Cattini, University of Modena and Reggio Emilia, Italy
Lorenzo Medici, CNH Industrial Italia spa, Italy
Luca Ferrari, CNH Industrial Italia spa, Italy
Luigi Rovati, University of Modena and Reggio Emilia, Italy

15:00 **Luminance Simulation in CARLA Under Cloud Coverage - Model Validation and Implications**
Fabian Ulreich, Technische Hochschule Ingolstadt, Germany
Elisabeth Moser, Ostbayerische Technische Hochschule Regensburg, Germany
Florian Olbrich, Ostbayerische Technische Hochschule Regensburg, Germany
Martin Ebert, Technische Hochschule Ingolstadt, Germany
Rudolf Bierl, Ostbayerische Technische Hochschule Regensburg, Germany
Andre Kaup, University of Erlangen-Nuremberg, Germany

14:20 **Research on Dual-Infrared Laser Based Speed Meter for Tunnel Traffic**
Weixian Zeng, Hunan Institute of Metrology and Test, China
Hao Tang, Hunan Institute of Metrology and Test, China
Wenhui Lin, Hunan Institute of Metrology and Test, China
Lan Yin, Hunan Institute of Metrology and Test, China
Wu Yao, Hunan Institute of Metrology and Test, China
Fu Lin, Hunan Institute of Metrology and Test, China
Qiuxi Deng, Hunan Institute of Metrology and Test, China
Zheng Peng, Hunan Institute of Metrology and Test, China
Zaichong Zhang, Hunan Institute of Metrology and Test, China
Feilong Wang, Potelissom Company Limited, China

14:40   **Research on Automatic Calibration Method of Transmission Loss for Millimeter-Wave Radar Testing System in Intelligent Vehicle**
Xiaomin Shen, Zhejiang Institute of Metrology, China
Jianwen Shao, Zhejiang Institute of Metrology, China
Xin Zhang, Zhejiang Institute of Metrology, China
Cunbin Zhao, Zhejiang Institute of Metrology, China
Kai Wang, Zhejiang Institute of Metrology, China
Lei Luo, Zhejiang Institute of Metrology, China
Bing Ouyang, Zhejiang Institute of Metrology, China

15:00   **ZPVehicles: A Dataset of Large Vehicle 3D Point Cloud Data**
Zhengzhou Ye, Zhejiang Institute of Metrology, China
Zihao Wang, Zhejiang Institute of Metrology, China
Xi Chen, Zhejiang Institute of Metrology, China
TianLong Zhou, Zhejiang Institute of Metrology, China
Chonghao Yu, Zhejiang Institute of Metrology, China
Junjun Guo, Zhejiang Institute of Metrology, China
Jian Li, Zhejiang Institute of Metrology, China

15:20   **Anti-Interference Algorithm of Environment-Aware Millimeter Wave Radar**
Jinzhou Dai, Beijing Institute of Metrology, China
Shuo Sha, Beijing Institute of Metrology, China
Yao Yao, Beijing Institute of Metrology, China

15:40 - 16:00   *Palazzo Ducale - Aula Magna*
                        CLOSING AND AWARD CEREMONY