IEEE

UNIVERSITAT POLITÈCNICA DE CATALUNYA BARCELONATECH

2025 IEEE INTERNATIONAL WORKSHOP ON

Metrology for Industry4.0 & IoT

CASTELLDEFELS, SPAIN, JULY 1-3, 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 wish to welcome you to the *2025 IEEE International Workshop on Metrology for Industry 4.0 and IoT*. It is a pleasure to have you here at this 8th edition of *IEEE MetroInd4.0&IoT* Workshop, and we hope that it will provide you with new insights into various aspects of electronic instrumentation and measurement. Of course, we also hope that it will facilitate fruitful collaborations between participants. These collaborations may arise during the different sessions or during coffee breaks and conference lunches. It is up to all of us to make them happen.

This eighth edition is being held in Castelldefels, Barcelona, Spain. This is the first time it has been held outside Italy. The local organisation has been led by Universitat Politècnica de Catalunya, but this would not have been possible without the expertise of the organising committee, which included active participation from the University of Brescia, the University Campus Bio-Medico di Roma and the University of Trento, as well as the invaluable contribution of the University of Sannio. Thanks to them, this workshop has become a reality.

This prestigious event brings together leading academics, industry experts and practitioners from around the world to discuss the critical role of metrology in the rapidly evolving fields of Industry 4.0 and the Internet of Things (IoT).

During the workshop, we will explore a comprehensive programme featuring cutting-edge research, innovative methodologies and practical applications that are shaping the future of instrumentation and measurement in various fields. Key topics at this year's conference include advances in precision measurement technologies and sensor networks, the implementation of IoT in industrial processes, and the development of measurement systems in two important areas: eHealth systems and agricultural applications. These sessions aim to provide information on the latest trends, challenges and solutions in these research areas. We would like to thank the researchers who proposed the special sessions that form the core of the workshop.

The extended abstracts received were submitted to a peer-review process. The main attributes for acceptance and publication in the Proceedings were relevance, quality, significance and novelty of the scientific contribution. The proceedings will be submitted for publication in the IEEEXplore Digital Library. We would like to thank all the reviewers who contributed to selecting and improving the quality of the works presented.

In addition to the sessions for presenting scientific papers, *Metroind2025* will feature three tutorials covering different fields.

- On the first day, Cecilio Angulo and Pere Ponsa, researchers at the Research Centre on Intelligent Data Science and Artificial Intelligence (IDEAI-UPC), will present a tutorial on metrics for human-robot collaboration (HRC) in Industry 4.0, an area in which artificial intelligence is becoming increasingly important.

- On the second day, Jaume Anguera, founder and CTO at Ignion and professor at Ramon Llull University, will present 'Enhancing Connectivity with Antenna Booster Technology for a Sustainable Future'. This presentation will cover the fundamentals of antenna booster technology and its applications in modern wireless technology.
- Pedro Ramos (Instituto Superior Técnico, University of Lisbon) will give a talk on 'Monitoring and Measuring Power Quality' on the last day of the workshop. This is an important issue for the future of Industry 4.0, as power quality (PQ) monitoring and measurements are crucial for the stability, reliability, and efficiency of electrical power systems that supply production systems.

We would like to express our sincere gratitude to our distinguished speakers, sponsors, patrons, and the organizing committee for their tireless efforts and support in making this event possible. We encourage all attendees to actively participate in the discussions and take advantage of the networking opportunities to build lasting professional relationships.

The Best Conference Paper Award, sponsored by Sensors Journal, will be given to recognize the most outstanding paper presented at the *2025 IEEE International Workshop on Metrology for Industry 4.0 and IoT*. Other awards will be given for the best paper presented by a young researcher, sponsored by Denodl, and for the best paper presented by a woman, sponsored by the IEEE Spain Section Affinity Group of Women in Engineering. These awards recognize the full engagement of women in all aspects of metrology in Industry 4.0 and the IoT.

We hope you find your time at IEEE MetroInd4.0&IoT 2025 intellectually stimulating and professionally rewarding. We trust you will find the conference inspiring and enriching. We look forward to your contributions to advancing the field of metrology in Industry 4.0 and the IoT.

The *2025 IEEE International Workshop on Metrology for Industry 4.0 and IoT* is about to begin! Metrologists, industrial ICT engineers, and IoT designers, enjoy the workshop!

June 2025

Oscar Casas, Universitat Politècnica de Catalunya, Spain
Mauro Serpelloni, University of Brescia, Italy
Pasquale Daponte, University of Sannio, Italy

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Metrics for Human-Robot Collaboration (HRC) in Industry 4.0

Cecilio **Angulo**, Pere **Ponsa**

Universitat Politècnica de Catalunya, Spain

ABSTRACT

The rise of collaborative robots (cobots) in Industry 4.0 has transformed traditional manufacturing by enabling seamless interaction between humans and machines. However, integrating cobots into industrial settings presents new challenges in evaluating their effectiveness. Traditional productivity metrics like cycle time and defect rates must now expand to include usability, cognitive workload, interaction fluency, and operator well-being.

A critical aspect of this integration is usability assessment. This measurement goes beyond mere functionality—it measures effectiveness, efficiency, and user satisfaction. Developing tailored usability benchmarks for cobots is essential, as conventional human-computer interaction models may not fully capture the dynamics of physical and cognitive collaboration. Moreover, balancing the cognitive and physical workload between humans and robots is another key issue. Human operators excel in tasks requiring adaptability, fine motor skills, and decision-making, but their performance declines under excessive physical strain. Cobots, on the other hand, perform repetitive, high-precision tasks effortlessly but lack advanced cognitive abilities. This balance not only maintains productivity but also enhances job satisfaction, as workers experience reduced fatigue and greater engagement.

To fully realize the potential of human-robot collaboration, Industry 4.0 must adopt a holistic approach to performance measurement. Case studies in shared workspaces have begun to refine these metrics, offering structured methodologies, task-specific questionnaires, and performance analysis techniques to assess cobot usability in real-world scenarios. Future advancements will depend on standardized frameworks that integrate these dimensions, ensuring cobots enhance efficiency without sacrificing the human element that drives innovation.

SPEAKERS BIOGRAPHIES

Cecilio Angulo

BSc/MSc in Mathematics from the University of Barcelona, Spain and PhD in Sciences from the Universitat Politècnica de Catalunya (UPC).

Full Professor of Artificial Intelligence and Robotics at UPC. Former Head Director of the Research Centre on Intelligent Data Science and Artificial Intelligence (IDEAI-UPC). Currently he is UPC AI Champion and President of the Catalan Association for Artificial Intelligence, a member of EurAI. He is also a member of the expert board for AI at Barcelona City Hall.
He has worked on theoretical aspects on machine learning, computer vision and robotics, as well as applications on recommender systems, cognitive robotics and assistive technologies. He has authored books in machine learning and robots, and published more than 350 papers in international and national journals and conferences. He has led and participated in 57 R&D competitive projects, 21 of them funded by the European Commission.

Pere Ponsa
Degree in Science (Physics) from the Universitat Autónoma de Barcelona UAB, Spain, PhD from the Universitat Politècnica de Catalunya UPC. Associate Professor in the Department of Automatic Control. He is member of the Smart Control Systems research group and member of the Association of Human-Computer Interaction (AIPO). He served as Conference Chair of Interacción'15 XVI International Conference on human-Computer Interaction (Vilanova i la Geltrú, Spain).
He has worked as a professor of industrial robotics at the UAB University and at several UPC University Schools (EPSEVG, ETSEIB, EEBE). He has worked on qualitative reasoning, human supervision, display design and human-automation interaction. He has authored chapter books in operational modes for industrial automation, human-robot collaboration and he has participated in the White Book on Robotics in Spain. He has published more than 130 scientific papers and international conference papers. He has participated in 14 R&D competitive projects and 12 teaching innovation projects (role playing, project-based learning).

Plenary Session - Wednesday July 2 - H 10:40

Enhancing Connectivity with Antenna Booster Technology for a Sustainable Future

Jaume **Anguera**
Ramon Llull University, Spain

ABSTRACT

For many years, antenna and microwave engineering have been developed separately. Microwave engineers focus on controlling radio waves, while antenna engineers design complex antennas to send signals.
Antenna booster technology is changing this. Instead of needing custom antennas, antenna boosters are small, standard parts that can be easily added to devices. They fit onto circuit boards just like any other electronic component, making the design and manufacturing of wireless devices, like IoT, much faster and easier.
Antenna boosters not only improve connectivity but also help create more efficient and environmentally friendly devices, leading to a more sustainable future. The presentation will cover the basics of antenna booster technology and how they are being used in today's wireless technology.

SPEAKER BIOGRAPHY

Dr. Jaume Anguera, IEEE Fellow, founder and CTO at Ignion. Professor at Ramon LLull University. With 25 years of experience both in industry and academia, he is an inventor of more than 180 granted patents, licensed to telecom companies. +200 million devices adopted his invented technology. Inventor of Antenna Booster Technology, which fostered the creation of Ignion. Between 2003 to 2006, he was with Fractus in Korea to head up the research team. One of his main tasks was to provide development of the team's core competency and R&D vision to address the rapidly growing mobile device market. Under his leadership, the company had secured major contracts with companies such as Samsung, LG, and Bellwave, to name a few. Author +300 scientific papers. He has participated in +24 funded research projects exceeding €14M. He has been invited +90 antenna lectures worldwide and directed the engineering, master, and Ph.D thesis of +195 students. Published 7 books and 10 proceedings. He is an IEEE Antennas and Propagation Distinguished Lecturer.

Plenary Session - Thursday July 3 - H 11:30

Monitoring and measuring power quality

Pedro M. **Ramos**
Instituto Superior Técnico - University of Lisboa, Portugal

ABSTRACT

Power quality (PQ) monitoring and measurements are crucial for the stability, reliability, and efficiency of electrical power systems. PQ events can cause equipment failures, increased operational costs and system downtime. Disturbances such as interruptions, voltage sags, swells, harmonics, transients, and flicker can disrupt operations and damage electrical equipment. These disturbances may originate from sources such as load switching, lightning strikes, faulty wiring, nonlinear loads, and fluctuations in supply voltage. Monitoring these issues allows industries, utilities, and businesses to maintain smooth operation, protect sensitive equipment, and comply with international power quality standards. Power quality analyzers monitor and register PQ disturbances/events over time, providing insights into power quality trends. Smart meters, increasingly used in modern grids, are also beginning to provide real-time power quality monitoring. These measurement techniques can play a crucial role in identifying power quality issues before they cause system/equipment failures.

This presentation describes our research in the last 20 years in PQ monitoring and embedded measurement systems for PQ assessment. Initially focus was centered on the construction of a comprehensive database of real measured PQ events. The database was built using multiple computer-based systems, commercial data acquisition boards and custom voltage/current sensor modules. In parallel, innovative algorithms were developed for the detection and characterization of PQ events. The next stage dealt with the development and deployment of embedded measurement devices capable of real-time detection of PQ events, their characterization and logging. More recently machine learning based solutions for detection and characterization of PQ events have been used.

SPEAKER BIOGRAPHY

Pedro M. Ramos received the Diploma, MSc. and Ph.D. degrees in Electrical and Computer Engineering (ECE) from Instituto Superior Técnico (IST), Technical University of Lisbon (UTL) now University of Lisbon (UL), Portugal, in 1995, 1997 and 2001. Associate Professor with habilitation at the Department of Electrical and Computer Engineering from IST, UL, and member of the

teaching and research staff since 1999. Senior researcher of the Instrumentation and Measurements Research Group at Instituto de Telecomunicações (IT). Current research interests include power quality monitoring and measurements, impedance measurements, impedance spectroscopy, non-destructive testing and battery impedance spectroscopy. IEEE Senior Member and Member of IMEKO-TC4 Measurement of Electrical Quantities. Editor of Measurement from Elsevier and Metrology from MDPI.

IEEE MetroInd 2025 Venue

IEEE MetroInd 2025 will be held at the **Castelldefels School of Telecommunications and Aerospace Engineering** (EETAC-UPC) - Castelldefels.
The School of Telecommunications and Aerospace Engineering (EETAC) is a higher education school of the Universitat Politècnica de Catalunya that offers Bachelor's degrees, Master's degrees and several Doctoral programs in the fields of Telecommunications and Aerospace Engineering. The School is renowned for its strong commitment with educational innovation and quality. This commitment is strengthened through a wide research activity strongly related with the industry, aiming at transferring the results to our Society.

ADDRESS

Esteve Terradas, 7
08860 Castelldefels

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

IEEE MetroInd 2025 Social Events

WELCOME PARTY
Tuesday July 1 - H 19:30

The IEEE Metroind 2025 **Welcome Party** will be held at "*El Marítim Restaurant*" on Tuesday, July 1 - 19:30.

One of the pleasures of Castelldefels is watching the sun set over the Mediterranean Sea. You can enjoy this view from the beachfront restaurant, El Marítim.

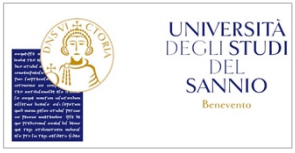
ADDRESS
Pg. Marítim, 17
08860 Castelldefels, Barcelona

GALA DINNER
Wednesday July 2 - H 20:15

The Gala Dinner will be held at the restaurant "*Rebost*" in the Hotel "*Ciudad de Castelldefels*" on Wednesday July 2 - 20.15.

ADDRESS
Hotel "Ciudad de Castelldefels"
Passeig de la Marina, 212, 08860 Castelldefels, Barcelona

IEEE MetroInd 2025 Patronages



Program Schedule - Tuesday, July 1

TUESDAY JULY 1		
11:15 - 11:30	OPENING CEREMONY	
	Aula 023G	Aula 021B
11:30 - 12:30	S1.1 - Non-invasive Measurements in IoT Devices for Cardiovascular	S1.2 - Reliable Wireless Solutions for IoT and Industrial IoT
12:30 - 13:45	LUNCH	
14:00 - 14:40	TUTORIAL SESSION #1 - Cecilio Angulo, Pere Ponsa Metrics for Human-Robot Collaboration (HRC) in Industry 4.0	
	Aula 023G	Aula 021B
14:40 - 16:20	S2.1 - Measurements and Virtual Measurements towards Industry 5.0: Approaches and Solutions for Smart Manufacturing	S2.2 - Innovation in Sensor and Measurement Systems - PART I
16:20 - 16:40	COFFEE BREAK	
16:40 - 18:00	S3.1 - Advances in Measurements for Biomedical and Industrial Field for Human Monitoring - PART I	S3.2 - IoT Systems. Design, Standards and Security
19:30	WELCOME PARTY - El marítim Restaurant	

Program Schedule - Wednesday, July 2

WEDNESDAY JULY 2			
	Aula 023G	Aula 021B	Aula 024G
09:00 - 10:20	S4.1 - Advances in Measurements for Biomedical and Industrial Field for Human Monitoring - PART II	S4.2 - Innovation in Sensor and Measurement Systems - PART II	S4.3 - Techno-Natural Systems: Sustainable Wireless Communications for Ecosystem Preservation - PART I
10:20 - 10:40	COFFEE BREAK		
10:40 - 11:30	TUTORIAL SESSION #2 - Jaume Anguera Enhancing Connectivity with Antenna Booster Technology for a Sustainable Future		
	Aula 023G	Aula 021B	Aula 024G
11:30 - 12:30	S5.1 - Advances in Measurements for Biomedical and Industrial Field for Human Monitoring and Measurements	S5.2 - Advances in Measurement Systems for Environmental Monitoring in Industrial and Agriculture Field - PART I	S5.3 - Techno-Natural Systems: Sustainable Wireless Communications for Ecosystem Preservation - PART II
12:30 - 13:45	LUNCH		
14:00 - 15:40	S6.1 - Wearables for Physiological and Human Activities Monitoring: Sensors, Algorithms and Applications - PART I	S6.2 - Advances in Measurement Systems for Environmental Monitoring in Industrial and Agriculture Field - PART II	
15:40 - 16:00	COFFEE BREAK		
16:00 - 17:40	S7.1 - Wearables for Physiological and Human Activities Monitoring: Sensors, Algorithms and Applications - PART II	S7.2 - Optical sensors for application in healthcare, plant sciences and smart food production	
20:15	GALA DINNER - Restaurant "Rebost" in the Hotel "Ciudad de Castelldefels"		

Program Schedule - Thursday, July 3

THURSDAY JULY 3			
	Aula 023G	Aula 021B	Aula 024G
09:10 - 11:10	S8.1 - Measurement Systems for Human Motion and Activity Analysis	S8.2 - Innovation in Sensor and Measurement Systems - PART III	S8.3 - Control, Diagnosis and Supervision of the Measurement Systems
11:10 - 11:30	COFFEE BREAK		
11:30 - 12:15	TUTORIAL SESSION #3 - Pedro M. Ramos Monitoring and Measuring Power Quality		
12:15 - 12:30	AWARDS AND CLOSING CEREMONY		
12:30 - 13:45	LUNCH		

Technical Program - Tuesday, July 1

10:30 - 17:30	*Conference Venue - EETAC-UPC - Aula 028-1* **REGISTRATIONS**

11:15 - 11:30	*EETAC-UPC - Aula 023G* **WELCOME ADDRESSES - OPENING CEREMONY**

11:30 - 12:30	*EETAC-UPC - Aula 023G* **Session 1.1 - Non-invasive measurements in IoT devices for cardiovascular monitoring** **Chairs:** Oscar Casas, *Universitat Politècnica de Catalunya, Spain* Ramon Casanella, *Universitat Politècnica de Catalunya, Spain*

11:30 **Beat-to-Beat Assessment of (dZ/Dt)Min in Hand-to-Hand IPG as a Surrogate for ICG**
Jorge Enrique Baños Bautista, Sr (Centro de Investigación y Estudios Avanzados del IPN, Mexico); Jose Alberto Garcia Limon (Universitat Politècnica de Catalunya, Spain); Emiliano Rojano Hernández and Carlos Alvarado Serrano (Centro de Investigación y Estudios Avanzados del IPN, Mexico); Ramon Casanella (Universitat Politecnica de Catalunya, Spain)

11:50 **Comparison of Single Foot IPG and PPG as a Distal PAT in Wearable Devices**
Jose Alberto Garcia Limon and Oscar Casas (Universitat Politècnica de Catalunya, Spain); Carlos Alvarado Serrano (Centro de Investigación y Estudios Avanzados del IPN, Mexico); Ramon Casanella (Universitat Politecnica de Catalunya, Spain)

12:10 **PPG Acquisition from a Sensorized Insole for Worker Health Monitoring**
Giada Giorgi, Thomas Jahreis, Riccardo Bagno and Claudio Narduzzi (Universita' di Padova, Italy)

11:30 - 12:30	*EETAC-UPC - Aula 021B* **Session 1.2 - Reliable wireless solutions for IoT and Industrial IoT** **Chair:** Paolo Ferrari, *University of Brescia, Italy*

11:30 **A Smart Campus Multi-Access Communication Infrastructure: Performance of the 5G Side**
Enrico Brunelli, Salvatore Dello Iacono, Alessandro Depari, Paolo Ferrari, Alessandra Flammini, Massimiliano Gaffurini, Stefano Rinaldi and Emiliano Sisinni (University of Brescia, Italy)

11:50 **Wide Area, IoT-Based PID Control of Slow Systems over LoRaWAN**

Massimiliano Gaffurini, Enrico Brunelli, Dennis Brandão, Alessandro Depari, Alessandra Flammini, Stefano Rinaldi, Emiliano Sisinni and Paolo Ferrari (University of Brescia, Italy)

12:10 **Timing Challenges in Vehicular TinyML: Characterizing End-to-End Latency**
Hilton Machado, Matheus Andrade, Marianne Silva and Ivanovitch Silva (Federal University of Rio Grande do Norte, Brazil); Dennis Brandão and Paolo Ferrari (University of Brescia, Italy)

12:30 - 13:45	*Campus Restaurant* **LUNCH**

14:00 - 14:40	*EETAC-UPC - Aula 023G* **PLENARY SESSION - TUTORIAL** **Chairs**: Oscar Casas, *Universitat Politècnica de Catalunya, Spain* Mauro Serpelloni*, University of Brescia, Italy*

Metrics for Human-Robot Collaboration (HRC) in Industry 4.0

Cecilio Angulo, Pere Ponsa, *Universitat Politècnica de Catalunya, Spain*

14:40 - 16:20	*EETAC-UPC - Aula 023G* **Session 2.1 - Measurements and Virtual Measurements towards Industry 5.0: Approaches and Solutions for Smart Manufacturing** **Chairs:** Giulio D'Emilia, *University of L'Aquila, Italy* Antonella Gaspari, *Politecnico di Bari, Italy*

14:40 **Metrological Characterization of Stand-off Distance Measurement by off-Axis Camera in DED Metal Additive Manufacturing**
Vittorio Sala, Ambra Vandone, Michele Banfi, Federico Mazzucato and Stefano Baraldo (SUPSI, Switzerland); Anna Valente (SUPSI-ISTEPS, Italy)

15:00 **Repeatability and Reproducibility Method of Hand-Handle Laser Triangulation Profilometer**
Guerino Gianfranco Paolini (Università Politecnica delle Marche, Italy); Matteo Nisi (U-SENSE, Italy); Sara Casaccia and Federica Amicucci (Università Politecnica delle Marche, Italy); Cristiana Cristalli (U-SENSE, Italy); Nicola Paone (Università Politecnica delle Marche, Italy)

15:20 **Integrated Sensors for Structural Health Monitoring: Groundwork for an Interlaboratory Comparison**
Luciano Chiominto and Giulio D'Emilia (University of L'Aquila, Italy); Flavio Dipietrangelo (University of Salento, Italy); Antonella Gaspari (Politecnico di Bari, Italy); Emanuela Natale (University of L'Aquila, Italy); Francesco Nicassio (University of Salento, Italy); Gennaro Scarselli (University of Southampton, United Kingdom)

15:40 **SFRA Measurement System in AR Environment for Users' Awareness of Batteries' State of Health**
Fabrizio Ciancetta (University of L'Aquila, Italy); Annalisa Liccardo and Ida Papallo (University of Naples Federico II, Italy); Simone Mari and Andrea Fioravanti (University of L'Aquila, Italy); Luigi Ferrigno (University of Cassino, Italy)

16:00 **Application of Improved PSO with Dynamic Inertia Weight Adjustment in 3D Path Planning of UAV**
Lefan Zhang (Newcastle University, United Kingdom & Nanjing Institute of Technology, China)

14:40 - 16:20 *EETAC-UPC - Aula 021B*
Session 2.2 - Innovation in Sensor and Measurement Systems - PART I
Chairs: Davide Brunelli, *University of Trento, Italy*
Ernesto Serrano, *Universitat Politècnica de Catalunya, Spain*

14:40 **QCM-D with at-Cut Quartz First Spurious Mode: Experimental Characterization Under Different Mechanical Loads**
Elia Landi, Ada Fort, Marco Mugnaini and Valerio Vignoli (University of Siena, Italy); Vincenzo Paciello (University of Salerno, Italy); Salvatore Dello Iacono (University of Brescia, Italy)

15:00 **QCM Measurement of Highly Dense Fluids, a Measurement Technique Based on Sine Sweep Excitation**
Elia Landi, Ada Fort, Marco Mugnaini and Valerio Vignoli (University of Siena, Italy); Shumaila Mushtaq, Antonio Moschitta and Paolo Carbone (University of Perugia, Italy)

15:20 **Capacitive Sensing Systems Analysis for Oil Quality Monitoring of Hydraulic Systems**
Luca Tari, Aurelio Cesarano, Filippo Milano, Cecilia Provenzale, Luigi Ferrigno and Giorgio Ficco (University of Cassino and Southern Lazio, Italy)

15:40 **Validation and Optimization of a Low-Cost Sensor for the Measurement of the Radial Displacements of a Cylindrical Conductive Target**
Nicola Iacono (University of Brescia & STIIMA-CNR, Italy); Matteo Lancini (University of Brescia, Italy); Giacomo Bianchi and Gianmauro Fontana (STIIMA-CNR, Italy)

16:00 **Reducing Type a Uncertainty of Quasi Adiabatic Calibration Factor in a Graphite Calorimeter for Radiation Dosimetry Measurements**
Susy Toma (University of Cassino-Enea INMRI, Italy); Massimo Pinto, Gianluca Cappadozzi and Carlo DI Ianni (ENEA, Italy); Fausto Arpino and Domenico Capriglione (University of Cassino and Southern Lazio, Italy)

16:20 - 16:40	*EETAC-UPC - Aula 028-1* **COFFEE BREAK**

16:40 - 18:20	*EETAC-UPC - Aula 023G* **Session 3.1 - Advances in Measurements for Biomedical and Industrial field for Human Monitoring - PART I** **Chairs:** Mauro Serpelloni, *University of Brescia, Italy* Giorgia Fiori, *University of Roma Tre, Italy*

16:40 **Wireless Instrumented Ankle Foot Orthosis (AFO) for Gait Cycle Monitoring: a Preliminary Study**
Soufiane Mahraoui and Mauro Serpelloni (University of Brescia, Italy)

17:00 **Development and Testing of a Scaled Prototype of a Cantilever-Based Piezoelectric MEMS Actuator for Arbitrary XY Path Generation**
Gabriele Bocchetta, Giorgia Fiori, Fabio Botta, Andrea Scorza and Salvatore Andrea Sciuto (Roma Tre University, Italy)

17:20 **Volumetric Assessment for Quality Control in 3D Printed Bone Models: a Preliminary Investigation**
Marta Cecchitelli and Giorgia Fiori (Roma Tre University, Italy); Alessandro Luchetti (University of Trento, Italy); Jan Galo (IRCCS Children Hospital Bambino Gesù, Italy); Salvatore Andrea Sciuto and Andrea Scorza (Roma Tre University, Italy)

17:40 **Mechanical Properties of Soft Materials in 3D Printing: a Preliminary Quality Assessment**
Marta Cecchitelli, Giorgia Fiori, Annalisa Genovesi and Massimiliano Barletta (Roma Tre University, Italy); Jan Galo (IRCCS Children Hospital Bambino Gesù, Italy); Andrea Scorza and Salvatore Andrea Sciuto (Roma Tre University, Italy)

18:00 **One-Shot Exploration of Tissue Biomechanics: a Mechatronic Platform with Edge-Processed Multi-Sensory Data Architecture**
Lisa Bernardo (Sant'Anna School of Advanced Studies, Italy); David Siorpaes and Alessandro Vaghi and Giuseppe Desoli (STMicroelectronics); Calogero Maria Oddo and Fabrizia Auletta (Scuola Superiore Sant'Anna, Italy)

16:40 - 18:00	*EETAC-UPC - Aula 021B* **Session 3.2 - IoT Systems. Design, Standards and Security** **Chairs:** Paolo Ferrari, *University of Brescia, Italy* Gemma Hornero Ocaña, *Universitat Politècnica de Catalunya, Spain*

16:40 **Challenges in Adapting Flush+Reload to the Web**
Felipe Da Silva Simões (Universidade Federal Fluminense, Brazil); Lucila M. S. Bento (State University of Rio de Janeiro, Brazil); Raphael Machado (Inmetro and UFF, Brazil)

17:00 **Side-Channel Measurements and Machine Learning for Classifying Application-Level Scenarios in IoT Contexts**
Vincenzo Rega, Luca Tari, Domenico Capriglione, Mario Molinara and Fabrizio Marignetti (University of Cassino and Southern Lazio, Italy)

17:20 **IoT-Based Secure Cultivation of Mushroom**
Higor V Rosse (Collaborative Laboratory Mountains of Research, Portugal); Carla Pereira, Ana Saldanha and Maria Inês Dias (Instituto Politécnico de Bragança, Campus de Sta Apolónia, Portugal); Elisabete Freitas and Estefânia Gonçalves (Collaborative Laboratory Mountains of Research, Portugal)

17:40 **Study of Wireless Technologies for Designing a Wearable Inertial System**
Vasilis Konstantakos (Aristotle University of Thessaloniki, Greece)

19:30	*El Marítim Restaurant* **WELCOME PARTY**

Technical Program - Wednesday, July 2

08:30 - 17:00	*Conference Venue - EETAC-UPC - Aula 028-1* **REGISTRATIONS**

09:00 - 10:20	*EETAC-UPC - Aula 023G* **Session 4.1 - Advances in Measurements for Biomedical and Industrial field for Human Monitoring - PART II** **Chairs:** Mauro Serpelloni, *University of Brescia, Italy* Giorgia Fiori, *University of Roma Tre, Italy*

09:00 **Accuracy in Velocity Measurements for Fault Detection in a Curvilinear Ultrasound Probe: a Case Study Simulating Failures Using Nylon Wires**
Giorgia Fiori, Salvatore Andrea Sciuto and Andrea Scorza (Roma Tre University, Italy)

09:20 **Pulse Wave Velocity Estimation Through Viscoelastic Behavior Analysis of an Arterial Surrogate with Variable Stiffness: a Validation Study**
Federico Filippi, Giorgia Fiori, Andrea Scorza, Salvatore Andrea Sciuto (Roma Tre University, Italy)

09:40 **Ion-Selective Sensors with Interdigitated Electrodes by Aerosol Jet Printing for Biomedical and Industrial Fields: a Preliminary Investigation**
Giorgia Polidori, Soufiane Mahraoui and Mauro Serpelloni (University of Brescia, Italy)

10:00 **Printed Soft Capacitive Sensor for Fingertip Contact Monitoring**
Paolo Bellitti, Michela Borghetti, Emilio Sardini and Mauro Serpelloni (University of Brescia, Italy)

09:00 - 10:20	*EETAC-UPC - Aula 021B* **Session 4.2 - Innovation in Sensor and Measurement Systems - PART II** **Chair:** Lorenzo Ciani, *University of Florence, Italy*

09:00 **Sensor-Equipped Joint Design for Accurate Trajectory Tracking in Soft Robots**
Elia Landi and Tommaso Lisini Baldi (University of Siena, Italy); Jonas Papenbrock (University of Pisa, Italy); Domenico Prattichizzo and Ada Fort (University of Siena, Italy); Michele Riccio (University of Naples Federico II, Italy)

09:20 **A Portable, Low-Power and Low-Cost Electronic Nose for Meat Freshness Assessment**
Mattia Stighezza, Valentina Bianchi and Ilaria De Munari (University of Parma, Italy)

09:40 **Data-Driven Innovations in Food Safety: the Role of AI and Big Data in METROFOOD-IT**
Michele Magarelli and Pierpaolo Di Bitonto (Università Degli Studi di Bari Aldo Moro, Italy); Donato Romano (Università Degli Studi di Bari Aldo Moro, Italy & Istituto Nazionale di Fisica Nucleare - INFN, Italy); Pierfrancesco Novielli (Università Degli Studi di Bari Aldo Moro and INFN-BA, Italy); Rameez Ahsen (University of Bari Aldo Moro, Italy); Claudia Zoani (ENEA - Italian National Agency for New Technologies, Energy and Sustainable Econ, Italy); Roberto Bellotti and Sabina Tangaro (Università Degli Studi di Bari Aldo Moro and INFN, Italy)

10:00 **Improving Failure Modes and Effects Analysis of a Lithium-Ion Battery Using Fuzzy-Based Risk Assessment**
Gabriele Patrizi, Alessandra Musacchio, Irene Sabatino and Lorenzo Ciani (University of Florence, Italy)

09:00 - 10:20 *EETAC-UPC - Aula 024G*
Session 4.3 - Techno-Natural Systems: Sustainable Wireless Communications for Ecosystem Preservation - PART I
Chairs: Maria Doglioni, *University of Trento, Italy*
Davide Brunelli, *University of Trento, Italy*
Alan Briones Delgado, *Universitat Ramon Llul, Spain*

09:00 **Self-Powered Plant Microbial Fuel Cell Monitoring Node with Autonomous Dynamic Capacitance**
Maria Doglioni (University of Trento, Italy); Oscar Casas (Universitat Politècnica de Catalunya, Spain); Matteo Nardello and Davide Brunelli (University of Trento, Italy)

09:20 **Evidentia: an Expandable Tool to Reliably Gather Green Metrics**
Daniel Gil-Morillo (La Salle - Universitat Ramon Llull, Spain)

09:40 **Indoor Plant Health Monitoring System Using NDVI Imaging, PMFC Sensing and Soil Moisture Data**
Alan Briones (La Salle Campus BCN - Ramon Llull University, Spain); Daniel Hess and Ariadna González (La Salle - Ramon Llull University, Spain); Daniël Groen (Plant-e, The Netherlands); Enrica Roccotiello (University of Genova, Italy); Andrea Conserva (Institut d'Arquitectura Avançada de Catalunya, Spain); Joan Navarro (La Salle Campus Barcelona, Universitat Ramon Llull, Spain)

10:00 **Stand-Alone Green Twin for Plant Microbial Fuel Cell (PMFC) Monitoring and Optimization**
Alan Briones (La Salle Campus BCN - Ramon Llull University, Spain); David Ferré (La Salle - Ramon Llull University, Spain); Armando Carpaneto and Enrica Roccotiello (University of Genova, Italy); Daniël Groen and Hadi Rajaei (Plant-e, The Netherlands); Agustin Zaballos (Enginyeria La Salle - Universitat Ramon Llull, Spain); Davide Brunelli (University of Trento, Italy)

10:20 - 10:40	*EETAC-UPC - Aula 028-1* **COFFEE BREAK**

10:40 - 11:30	*EETAC-UPC - Aula 023G* **PLENARY SESSION - TUTORIAL** **Chairs**: Oscar Casas, *Universitat Politècnica de Catalunya, Spain* Mauro Serpelloni*, University of Brescia, Italy*

Enhancing Connectivity with Antenna Booster Technology for a Sustainable Future

Jaume Anguera, *Ramon Llull University, Spain*

11:30 - 12:30	*EETAC-UPC - Aula 023G* **Session 5.1 - Advances in Measurements for Biomedical and Industrial field for Human Monitoring and Measurements** **Chairs:** Mauro Serpelloni, *University of Brescia, Italy* Giorgia Fiori, *University of Roma Tre, Italy*

11:30 **Z-Normalized Euclidean Distance-Based Approach for Heart Rate Estimation and Artifact Identification in PPG Signals**
Paolo Castello, Silvia Fullone, Paolo Attilio Pegoraro and Davide Sitzia (University of Cagliari, Italy)

11:50 **Influence of Reflected Waves on PWV Estimation via Cross-Correlation in a Variable-Stiffness Arterial Surrogate: in Silico Simulation**
Federico Filippi, Giorgia Fiori, Salvatore Andrea Sciuto and Andrea Scorza (Roma Tre University, Italy)

12:10 **Laser-Induced Graphene Electrodes for Wearable Electrochemical Analyses**
Vincenzo Vezzoni, Michele Setti, Daniele Pontiroli, Valentina Bianchi, Mattia Stighezza, Ilaria De Munari and Mauro Riccò (University of Parma, Italy)

11:30 - 12:30	*EETAC-UPC - Aula 021B* **Session 5.2 - Advances in Measurement Systems for Environmental Monitoring in Industrial and Agriculture Field - PART I** **Chairs:** Michela Borghetti, *University of Brescia, Italy* Francesco Santoni, *University of Perugia, Italy*

11:30 **Segmentation of Drivable Areas in GPS-Denied and Unstructured Orchard Environments**
Federico Girlanda and Farhad Shamsfakhr (Fondazione Bruno Kessler, Italy); Massimo Vecchio (OpenIoT Research Unit at FBK, Italy); Fabio Antonelli (Fondazione Bruno Kessler, Italy)

11:50 **A TinyMLOps-Based Edge AI Approach for Early Detection of Emerging Plant Diseases**
Hossein Aqasizade (University of Trento, Italy & Fondazione Bruno Kessler, Italy); Mattia Antonini (Fondazione Bruno Kessler, Italy); Massimo Vecchio (OpenIoT Research Unit at FBK, Italy); Fabio Antonelli (Fondazione Bruno Kessler, Italy)

12:10 **Preliminary Study on Electrochemical Sensors for Ion Detection in Agriculture and Environment by Aerosol Jet Printing**
Giorgia Polidori, Soufiane Mahraoui, Emilio Sardini and Mauro Serpelloni (University of Brescia, Italy)

11:30 - 12:30 *EETAC-UPC - Aula 024G*
Session 5.3 - Techno-Natural Systems: Sustainable Wireless Communications for Ecosystem Preservation. PART II
Chairs: Maria Doglioni, *University of Trento, Italy*
Davide Brunelli, *University of Trento, Italy*
Alan Briones Delgado, *Universitat Ramon Llul, Spain*

11:30 **Enhancing Connectivity with Leaf-Based Ground Planes for IoT Devices Embedding Antenna Boosters**
Jaume Anguera (Ignion & Universitat Ramon Llull, Spain); Aurora Andújar (Ignion, Spain); Inés Ripoll (Universitat Ramon LLull, Spain); Gerard Massana (Universitat Ramon Llull, Spain); Fabien Ferrero (Université Cote d'Azur, CNRS, LEAT & CREMANT, France); Leonardo Lizzi (University of Trento, Italy); Enrica Roccotiello and Armando Carpaneto (University of Genova, Italy)

11:50 **Wake-Up Radio with Plant-Microbial Fuel Cells Power Budget**
Manh-Thao Nguyen (Université Côte d'Azur & LEAT, France); Muhammad Aniq Daniel Bin Mohd Zakri (Université Côte d'Azur, France); Fabien Ferrero (Université Cote d'Azur, CNRS, LEAT & CREMANT, France); Cécile Belleudy (Université Côte d'Azur, Nice, France); Daniël Groen and Hadi Rajaei (Plant-e, The Netherlands); Alan Briones (La Salle Campus BCN - Ramon Llull University, Spain)

12:10 **Enhancing Efficiency of IOT Devices by Ground Plane Shaping with Antenna Boosters**
Sabrina Arus, Joan Navarro and Joan Pijoan (Universitat Ramon Llull, Spain); Aurora Andújar (Ignion, Spain); Jaume Anguera (Ignion & Universitat Ramon Llull, Spain)

12:30 - 13:45	*Campus Restaurant* **LUNCH**

14:00 - 15:40	*EETAC-UPC - Aula 023G* **Session 6.1 - Wearables for Physiological and Human Activities Monitoring: Sensors, Algorithms and Applications - PART I** **Chairs:** Carlo Massaroni, *Università Campus Bio-Medico di Roma, Italy* Mariangela Pinnelli, *Università Campus Bio-Medico di Roma, Italy*

14:00 **A Novel Machine Learning Framework for Drowsiness Detection Using an Electrostatic Wearable Sensor and Hyperdimensional Computing**
Ludovica Ferri, Michele Antonio Gazzanti Pugliese di Cotrone, Marco Angioli, Marco Balsi, Antonio Suppa and Leonardo Davì (Sapienza University of Rome, Italy); Nicola Picozzi, Alessandro Gumiero and Luigi Della Torre (STMicroelectronics); Fernanda Irrera (University of Roma La Sapienza, Italy)

14:20 **Flexible Dual-Material 3D-Printed Capacitive Force Sensors: Design, Fabrication, and Metrological Characterization**
Mariangela Pinnelli, Vincenzo Saroli, Gianpaolo Pennacchio, Chiara Romano, Roberto Setola, Emiliano Schena, Carlo Massaroni (Università Campus Bio-Medico di Roma, Italy)

14:40 **Design, Development and Characterization of a Single-Layer 3D-Printed Strain CB-TPU Sensor**
Vincenzo Saroli, Mariangela Pinnelli, Chiara Romano, Sergio Silvestri, Emiliano Schena and Carlo Massaroni (Università Campus Bio-Medico di Roma, Italy)

15:00 **Towards Non-Invasive Hemodynamic Monitoring: a Feasibility Analysis of Left Ventricular Ejection Time (LVET) Measurement with Wearable Inertial Sensors in Aortic Stenosis Patients**
Francesca Santucci, Chiara Romano and Mariangela Pinnelli (Università Campus Bio-Medico di Roma, Italy); Annunziata Nusca and Gian Paolo Ussia (Fondazione Policlinico Campus Bio-Medico, Italy); Sergio Silvestri, Emiliano Schena, Roberto Setola, Carlo Massaroni (Università Campus Bio-Medico di Roma, Italy)

15:20 **Multi-Modal Cardiopulmonary Sensing at the Chest Leveraging Hemodynamics and Cardiac Timings**
Omer T Inan, John Berkebile and Jacob M Cook (Georgia Institute of Technology, USA); Jesus Antonio Sanchez-Perez (University of Puerto Rico - Mayaguez, USA); H. Trask Crane (Georgia Institute of Technology, USA); Venu G. Ganti (Cardiosense, USA)

14:00 - 15:40	*EETAC-UPC - Aula 021B* **Session 6.2 - Advances in Measurement Systems for Environmental Monitoring in Industrial and Agriculture Field - PART II** **Chairs:** Michela Borghetti, *University of Brescia, Italy* Francesco Santoni, *University of Perugia, Italy*

14:00 **Lidar-IMU-GPS Based System for over Head Contact Line Geometry Assessment in Railways**
Fahad Mohammed Khan, Tsukasa Mizutani and Abhishek Regmi (Institute of Industrial Science, The University of Tokyo, Japan)

14:20 **Magnetic Ranging Comparison Between AC Coils and Hall-Effect Sensor**
Daniele Martini, Valerio Brunacci, Francesco Santoni, Shumaila Mushtaq and Antonio Moschitta (University of Perugia, Italy)

14:40 **MAGELLAN: a Python-Based End-to-End Simulator for Magnetic Localization Systems Using Magpylib**
Valerio Brunacci (University of Perugia, Italy); Cecilia Provenzale (University of Cassino and Southern Lazio, Italy); Chiara Carissimo (University of Molise, Italy); Filippo Milano (University of Cassino and Southern Lazio, Italy); Francesco Santoni and Antonio Moschitta (University of Perugia, Italy); Domenico Capriglione (University of Cassino and Southern Lazio, Italy)

15:00 **An Innovative Approach for Pollutants Detection in Industrial Wastewater: a Preliminary Analysis**
Gabriele Cavaliere (University of Salerno, Italy); Luca Tari (University of Cassino and Southern Lazio, Italy); Antonio Maffucci (University of Cassino and Southern Lazio & National Institute of Nuclear Physics, INFN-LNF, Italy); Luigi Ferrigno (University of Cassino, Italy)

15:20 **A WiFi Mesh Sensor Network for Sustainable Livestock Farming: Real-Time Monitoring System of NH3 and CO2 Emissions**
Maria Teresa Verde, Francesco Bonavolontà, Roberto Soldaini, Rosario Schiano Lo Moriello, Michela Zampano, Stefania Pindozzi, Alessandra Apostolico and Ester Scotto di Perta (University of Naples Federico II, Italy)

15:40 - 16:00 *EETAC-UPC - Aula 028-1*
COFFEE BREAK

16:00 - 17:40 *EETAC-UPC - Aula 023G*
Session 7.1 - Wearables for Physiological and Human Activities Monitoring: Sensors, Algorithms and Applications - PART II
Chairs: Carlo Massaroni, *Università Campus Bio-Medico di Roma, Italy*
Mariangela Pinnelli, *Università Campus Bio-Medico di Roma, Italy*

16:00 **Influence of Sampling Frequency on the Symmetric Projection Attractor Reconstruction**
Isabel Del Pilar Moscol, Chiara Romano and Mariangela Pinnelli (Università Campus Bio-Medico di Roma, Italy); Annunziata Nusca and Gian Paolo Ussia (Fondazione Policlinico Campus Bio-Medico, Italy); Emiliano Schena and Carlo Massaroni (Università Campus Bio-Medico di Roma, Italy)

16:20 **SISTINE 3.0: Plantar Pressure Assessment in Chronic Venous Disease During Figure-of-8 Test**
Chiara Oletto (University of Rome La Sapienza, Italy); Emanuele D'Angelantonio (Technoscience - Parco Scientifico e Tecnologico Pontino, Italy); Leandro Lucangeli (Università degli Studi di Roma "Foro Italico" & Technoscience - Parco Scientifico e Tecnologico Pontino, Italy); Salvatore Venosi and Augusto Orsini (Technoscience Rome, Italy); Valentina Camomilla (University of Rome Foro Italico, Italy)

16:40 **Comparison of Mattress-Embedded and Jugular-Mounted Inertial Sensors for Respiratory Monitoring During Sleep in Real-World Settings**
Chiara Romano, Francesca De Tommasi and Daniela Lo Presti (Università Campus Bio-Medico di Roma, Italy); Manish Sharma (Institute of Infrastructure Technology Research and Management (IITRAM), India); Sergio Silvestri, Emiliano Schena and Carlo Massaroni (Università Campus Bio-Medico di Roma, Italy)

17:00 **Artificial Intelligence for Non-Invasive Glucose Monitoring: ECG-Based Glycaemia Estimation in Type 1 Diabetes**
Claudia Ferraro (Università Campus Biomedico di Roma, Italy); Federico D'Antoni (Fondazione Policlinico Universitario Campus Bio-Medico di Roma, Italy); Lorenzo Petrosino, Filippo Crispino and Mario Merone (Università Campus Bio-Medico di Roma, Italy); Leandro Pecchia (Unicamps, USA)

17:20 **Robotic Tremor Simulation for Experimental Validation of Inertial Sensors in Neurodegenerative Disease Monitoring**
Giorgio de Alteriis and Rosario Schiano Lo Moriello (University of Naples Federico II, Italy); Gianni Cerro and Chiara Carissimo (University of Molise, Italy); Vincenzo Gallo (University of Salerno, Italy); Lorenzo Coppola, Francesco de Pandi and Francesco Cirillo (University of Naples Federico II, Italy); Consolatina Liguori and Marco Carratù (University of Salerno, Italy)

16:00 - 17:40 *EETAC-UPC - Aula 021B*
Session 7.2 - Optical sensors for application in healthcare, plant sciences and smart food production
Chairs: Emiliano Schena, *University Campus Bio-Medico of Roma, Italy*
Martina Pulcinelli, *University Campus Bio-Medico of Roma, Italy*
Ilaria Condò, *University Campus Bio-Medico of Roma, Italy*
Vincenzo Lavorgna, *University Campus Bio-Medico of Roma, Italy*

16:00 **Experimental Assessment of a 3D-Printed FBG-Based Forceps for Minimally Invasive Surgery: Gripping Tests on Ex Vivo Animal Tissues**
Vincenzo Lavorgna (University Campus Bio-Medico di Roma, Italy & ENEA, Italy); Martina Pulcinelli and Carlo Massaroni (Università Campus Bio-Medico di Roma, Italy); Guido Gabriele (Università degli Studi di Siena, Italy); Emiliano Schena (University Campus Bio-Medico of Rome, Italy); Daniela Lo Presti (Università Campus Bio-Medico di Roma, Italy)

16:20 **FBG-Based 3D-Printed Nearable Device for Cardiorespiratory Monitoring in Video Terminal Workers**
Francesco Avossa (Università Campus Bio-Medico di Roma, Italy); Vincenzo Lavorgna (University Campus Bio-Medico di Roma, Italy & ENEA, Italy); Martina Pulcinelli (Università Campus Bio-Medico di Roma, Italy); Alfredo Dimo (Fondazione Policlinico Universitario Campus Bio-Medico, Italy); Daniela Lo Presti (Università Campus Bio-Medico di Roma, Italy); Emiliano Schena (University Campus Bio-Medico of Rome, Italy)

16:40 **Manufacturing Process Optimization of Breast Phantoms to Assess Tactile Sensing Technologies for Noninvasive Tumor Detection**
Martina Pulcinelli and Carlo Massaroni (Università Campus Bio-Medico di Roma, Italy); Francesco Giurazza and Francesco Muto (Cardarelli Hospital, Italy); Vittorio Altomare and Antonella Grasso (Fondazione Policlinico Campus Bio-Medico, Italy); Emiliano Schena (University Campus Bio-Medico of Rome, Italy); Daniela Lo Presti (Università Campus Bio-Medico di Roma, Italy)

17:00 **Optimization of an Adhesive Wearable Sensor Based on Fiber Optic Technology for Plant Growth and Movement Monitoring**
Ilaria Condo, Sara Cimini and Laura De Gara (Università Campus Bio-Medico di Roma, Italy); Marcella Trombetta (CIR - Center of Integrated Research, University Campus Bio-Medico of Rome, Italy); Emiliano Schena (University Campus Bio-Medico of Rome, Italy); Sara Maria Giannitelli (CIR - Center of Integrated Research, University Campus Bio-Medico of Rome, Italy); Daniela Lo Presti (Università Campus Bio-Medico di Roma, Italy)

17:20 **Smart Food Production: Integration of IEC 61499 in Real-Time Control System**
Daniele Buonocore and Vincenzo Paciello (University of Salerno, Italy); Helbert da Rocha and António Espírito Santo (University of Beira Interior, Portugal); Reza Abrishambaf (Miami University, USA)

20:15 *Restaurant "Rebost" in the Hotel "Ciudad de Castelldefels"*
GALA DINNER

Technical Program - Thursday, July 2

08:30 - 12:00	*Conference Venue - EETAC-UPC - Aula 028-1* **REGISTRATIONS**

09:10 - 11:10	*EETAC-UPC - Aula 023G* **Session 8.1 - Measurement Systems for Human Motion and Activity Analysis** **Chairs:** Arianna Carnevale, *University Hospital Foundation Bio-Medical Campus, Italy* Carlo Massaroni, *University Campus Bio-Medico of Roma, Italy*

09:10 **An Ultrasonic-Based Metrological Approach for Fall Detection and User Recognition Using Supervised and Unsupervised Machine Learning Techniques**
Ilaria Ciuffreda, Sara Casaccia and Gian Marco Revel (Università Politecnica delle Marche, Italy)

09:30 **Lower-Limb Kinematics Changes During a 20 km Time Trial of Experienced Master Cyclists**
Ana Luiza de Castro Lopes (State University of Campinas, Brazil); Bruno Bedo (University of Sao Paulo, Brazil); Sergio Silvestri and Emiliano Schena (Università Campus Bio-Medico di Roma, Italy); Umile Giuseppe Longo and Arianna Carnevale (Fondazione Policlinico Universitario Campus Bio-Medico, Italy); Pietro Cerveri (University of Pavia, Italy); Richard Diego Leite (Federal University of Espirito Santo, Brazil); Amanda Piaia Silvatti (Federal University of Vicosa, Brazil); Karine Sarro (State University of Campinas, Brazil); Carlo Massaroni (Università Campus Bio-Medico di Roma, Italy)

09:50 **Preliminary Assessment of a Low-Sampling-Rate Wearable Head-Mounted Inertial Sensor System for Human Activity Recognition**
Mariangela Pinnelli, Isabel Del Pilar Moscol, Alessandro Dascola, Chiara Romano, Ilaria Condo and Francesca Santucci (Università Campus Bio-Medico di Roma, Italy); Alessandro Ledda (Istituto nazionale per l'assicurazione contro gli infortuni sul lavoro, Italy); Emiliano Schena, Roberto Setola and Carlo Massaroni (Università Campus Bio-Medico di Roma, Italy)

10:10 **3D Printed Wearable Sensor for the Evaluation of Joint Movement Planes**
Alfredo Dimo and Arianna Carnevale (Fondazione Policlinico Universitario Campus Bio-Medico, Italy); Martina Pulcinelli (Università Campus Bio-Medico di Roma, Italy); Vincenzo Lavorgna (University Campus Bio-Medico di Roma, Italy & ENEA, Italy); Emiliano Schena, Carlo Massaroni, Daniela Lo Presti and Umile Giuseppe Longo (Università Campus Bio-Medico di Roma, Italy)

10:30 **A New Method for Accurate Shoulder Strength Measurements**
Carla Antonacci (Università Campus Bio-Medico di Roma, Italy); Arianna Carnevale (Fondazione Policlinico Universitario Campus Bio-Medico, Italy); Letizia Mancini (Università Campus Bio-Medico di Roma, Italy & Fondazione Policlinico Universitario Campus Bio-Medico, Italy); Alessandro de Sire (University of Catanzaro Magna Graecia, Italy); Pieter D'Hoghe (Dept. of Orthopaedic Surgery and Sports Medicine, Aspetar Hospital Doha, Qatar); Carlo Massaroni (Università Campus Bio-Medico di Roma, Italy); Rocco Papalia (Fondazione Policlinico Universitario Campus Bio-Medico, Italy); Emiliano Schena (University Campus Bio-Medico of Rome, Italy); Umile Giuseppe Longo (Fondazione Policlinico Universitario Campus Bio-Medico, Italy)

10:50 **Impact of Marker-Set and Joint Constraint on Kinematic Outcome in Patients with Knee Osteoarthritis**
Letizia Mancini (Università Campus Bio-Medico di Roma, Italy & Fondazione Policlinico Universitario Campus Bio-Medico, Italy); Arianna Carnevale and Giovanni Spallone (Fondazione Policlinico Universitario Campus Bio-Medico, Italy); Carla Antonacci (Università Campus Bio-Medico di Roma, Italy); Stefano Campi (Fondazione Policlinico Universitario Campus Bio-Medico, Italy); Alessandro de Sire (University of Catanzaro Magna Graecia, Italy); Pieter D'Hoghe (Dept. of Orthopaedic Surgery and Sports Medicine, Aspetar Hospital Doha, Qatar); Carlo Massaroni (Università Campus Bio-Medico di Roma, Italy); Rocco Papalia (Fondazione Policlinico Universitario Campus Bio-Medico, Italy); Emiliano Schena (Università Campus Bio-Medico di Roma, Italy); Umile Giuseppe Longo (Fondazione Policlinico Universitario Campus Bio-Medico, Italy)

09:10 - 11:10 *EETAC-UPC - Aula 021B*
Session 8.2 - Innovation in Sensor and Measurement Systems - PART III
Chairs: Giulio D'Emilia, *University of L'Aquila, Italy*
Giorgia Fiori, *University of Roma Tre, Italy*

09:10 **Spectra Signature Assessment in Relation to CDWs Quality Using Hyperspectral Imaging in VIS-NIR Range**
Maria Teresa Calcagni, Giovanni Salerno (Università Politecnica Delle Marche, Italy); Gloria Cosoli (Università eCampus, Italy); Alessandra Mobili, Jacopo Donnini and Gian Marco Revel (Università Politecnica delle Marche, Italy)

09:30 **Absorption-Based Laser Mass Flow Meter Design for Iodine Based Applications**
Lorenzo Parri, Marco Mugnaini and Enza Panzardi (University of Siena, Italy); Carla Guidi, Manuel M Saravia and Alessio Ceccarini (University of Pisa, Italy); Elia Landi (University of Siena, Italy); Nils Gerrit Kottke (Airbus, Germany)

09:50 **Preliminary Development of a Small-Scale Prototype for a Novel Wave Energy Converter**
Gabriele Bocchetta, Giorgia Fiori, Marta Cecchitelli, Fabio Leccese, Nicola Pio Belfiore, Andrea Scorza and Salvatore Andrea Sciuto (Roma Tre University, Italy)

10:10 **Cyclic Intermittent Connectivity of Industrial Sensors Impacting Information Freshness**
Lucrezia Rossi and Leonardo Badia (University of Padova, Italy)

10:30 **Estimation of the Electric Capacity to Support Grid Ancillary Services Using Electric Vehicles**
Antonio Del Giudice (ENEA, Italy); Daniele Buonocore and Vincenzo Paciello (University of Salerno, Italy)

10:50 **A Modular Ultrasonic System for Non-Destructive Testing in Nuclear Power Plants**
Bartas Abaravicius and Fan Yang (University of Edinburgh, United Kingdom); Jean-François Saillant and Clara Borges (Framatome, France); Sandy Cochran (University of Glasgow, United Kingdom); Srinjoy Mitra (University of Edinburgh, United Kingdom)

09:10 - 11:10 *EETAC-UPC - Aula 024G*
Session 8.3 - Control, Diagnosis and Supervision of the Measurement Systems
Chair: Loredana Cristaldi, *Politecnico di Milano, Italy*

09:10 **A Multi-Model Robust Control Design for Uncertain AMB Systems**
Giovanni Donati (University of Florence, Italy); Massimiliano Ortiz Neri (Baker Hughes, Italy); MIchele Basso (University of Florence, Italy); Marco Mugnaini (University of Siena, Italy); Jerzy T. Sawicki (Cleveland State University, USA)

09:30 **A Statistical Method Combined with Load Profiling for the Predictive Diagnosis of Anomalies: a Preliminary Analysis**
Luca Tari, Federico Molinaro, Domenico Capriglione and Luigi Ferrigno (University of Cassino and Southern Lazio, Italy)

09:50 **A Novel Method for Transformer Diagnosis Based on Load Profiling: a Preliminary Analysis**
Luca Tari, Antonio Nardone, Federico Molinaro, Andrea Bernieri and Luigi Ferrigno (University of Cassino and Southern Lazio, Italy); Francesco Coratti (Tesmec Automation S.r.l, Italy)

10:10 **Improving the Robustness of Data-Driven Pipelines via the Adaptive Neuro-Fuzzy Inference System: an Industrial Use Case**
Aaqib Lone and Armir Bujari (University of Bologna, Italy)

10:30 **A Novel Benchmark for Fault Detection in Rolling Bearings Using CNNs and Monte Carlo Dropout**
Luca Martiri, Parisa Esmaili and Loredana Cristaldi (Politecnico di Milano, Italy)

10:50 **Leaked Age of Information of Preemptive Status Updates Against a Preemptive Eavesdropper**
Pietro Meneghini, Leonardo Badia (University of Padova, Italy)

11:10 - 11:30	*EETAC-UPC - Aula 028-1* **COFFEE BREAK**

11:30 - 12:15	*EETAC-UPC - Aula 023G* **PLENARY SESSION - TUTORIAL** **Chairs**: Oscar Casas, *Universitat Politècnica de Catalunya, Spain* Mauro Serpelloni*, University of Brescia, Italy*

Monitoring and Measuring Power Quality

Pedro M. Ramos, *Instituto Superior Técnico - University of Lisboa, Portugal*

12:15 - 12:30	*EETAC-UPC - Aula 023G* **CLOSING AND AWARD CEREMONY**

12:30 - 13:45	*Campus Restaurant* **LUNCH**