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Metrology for Industry 4.0 and IoT

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Virtual Conference

WORKSHOP PROGRAM

JUNE 7 - 9, 2021

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UNIVERSITÀ CAMPUS BIO-MEDICO DI ROMA

THE BIOROBOTICS INSTITUTE Sant'Anna

UNIVERSITÀ DEGLI STUDI DI BRESCIA

UNIVERSITÀ DEGLI STUDI DEL SANNIO

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MetroInd4.0&IoT 2021 Plenary Speakers

Plenary Monday, June 7, 2021 - H 09:30 CEST

Zero Defect Manufacturing: Integration of Quality Maintenance and Logistics

Tullio Tolio
Politecnico di Milano, Italy

ABSTRACT

Manufacturing companies are continuously facing the challenge of operating their manufacturing processes and systems in order to deliver the required production rates of high quality products , while minimizing the use of resources. Zero defect manufacturing is extremely relevant in technology intensive and emerging strategic manufacturing sectors, such as aeronautics, automotive, energy, medical technology, micro-manufacturing and electronics, mechatronics. Traditional six-sigma techniques show strong limitations in highly changeable production contexts, characterized by small batch productions, customized, or even one-of-a-kind products, and in-line product inspections. Innovative and integrated quality, production logistics and maintenance design, management and control methods as well as advanced technological enablers have a key role in achieving the overall zero defect manufacturing goal.

SPEAKER BIO

Tullio Tolio is Full Professor of "Manufacturing and Production Systems" at Politecnico di Milano. He has been the Director of the Institute ITIA-CNR in the period 2008-2018. He has been member of the National Habilitation Board of MUR for University professors in "Manufacturing and Production Systems". He is President of AITEM (the Italian Association for Manufacturing) and "Fellow" of CIRP (the International Academy for Production Engineering).

He has been member of the HLG on KETs and member of the Steering Committee of the program "Industry 4.0" of MISE (Italian Ministry of Economic Development). He is member of the MANUFUTURE HLG and member of the Partnership Board of EFFRA (European Factories of the Future Research Association).

He is President of the Scientific Technical Committee of the Italian Cluster "Intelligent Factories" CFI endorsed by MUR (Italian Ministry of University and Research) and President of the Scientific Technical Committee of the Cluster Intelligent Factories Lombardy AFIL endorsed by the Lombardy Region.

His research interests are in the area of circular economy, zero defect manufacturing, resilient manufacturing, configuration and reconfiguration of production systems, performance evaluation of production systems. He is the author of two books and more than 170 publications on international journals and conferences. He is Editor in Chief of the "CIRP Encyclopedia of Production Engineering". He is member of the Editorial Board of the "CIRP Journal of Manufacturing Science and Technology (CIRP-JMST)". He has been the Director of the Italian Flagship Project "Factories of the Future-Italy" launched and funded by MUR.

Plenary Monday, June 7, 2021 - H 16:20 CEST

Challenges of Measuring Human Physical Interaction

Neville Hogan

MIT - Massachusetts Institute of Technology, United States

ABSTRACT

Humans will soon share their space with robots. Pioneering clinical and medical applications already indicate the benefits of physical human-robot collaboration. Successful physical collaboration between humans and robots requires a quantitative knowledge of human sensory-motor performance, but humans' extreme adaptability presents a particular challenge: attempts to measure performance induce fundamental changes of performance. Measurement of standing balance provides an example: applying perturbations to identify control system dynamics invariably induces a change of posture. Recent non-perturbing methods that may circumvent this problem will be reviewed.

Quantifying physical interaction dynamics is even more challenging. Mechanical impedance at points of contact provides information essential to assess interaction stability and performance. Recent measurements during locomotion show that multi-variable ankle mechanical impedance is time-varying, but both passive and dissipative; moreover, dissipation increases with muscle activation. However, the small stochastic perturbations applied to measure mechanical impedance may change it, over-exciting muscle spindles which may contribute to mechanical impedance via spinal reflex feedback. Non-contact mechanical impedance measurement appears impossible, but recent studies will be reviewed which showed that humans have a remarkable ability to assess stiffness without physical contact or perturbation. Some implications for physical human-robot collaboration will be considered.

SPEAKER BIO

Neville Hogan is Sun Jae Professor of Mechanical Engineering and Professor of Brain and Cognitive Sciences at the Massachusetts Institute of Technology. He earned a Diploma in Engineering (with distinction) from Dublin Institute of Technology and M.S., Mechanical Engineer and Ph.D. degrees from MIT. He joined MIT's faculty in 1979 and presently Directs the Newman Laboratory for Biomechanics and Human Rehabilitation. He co-founded Interactive Motion Technologies, now part of Bionik Laboratories. His research includes robotics, motor neuroscience, and rehabilitation engineering, emphasizing the control of physical contact and dynamic interaction. Awards include: Honorary Doctorates from Delft University of Technology and Dublin Institute of Technology; the Silver Medal of the Royal Academy of Medicine in Ireland; the Henry M. Paynter Outstanding Investigator Award and the Rufus T. Oldenburger Medal from the American Society of Mechanical Engineers, Dynamic Systems and Control Division; the Academic Career Achievement Award from the Institute of Electrical and Electronics Engineers, Engineering in Medicine and Biology Society; and the Saint Patrick's Day Medal for Academia from Science Foundation Ireland.

Plenary Tuesday, June 8, 2021 - H 09:00 CEST

Reshaping Measurements in the 4.0 Era

Leopoldo Angrisani

University of Naples Federico II, Italy

General Manager/Director of CeSMA – Center of Advanced Measurement and Technology Services

MedITech Technical-Scientific Committee Coordinator

ABSTRACT

The ongoing 4.0 Era revolution is fostering the transition towards more flexible, automated and efficient processes. This objective is pursued through a number of enabling technologies (IoT, cloud computing, big data, wideband connectivity, augmented reality, robotics and so on), which separately or collectively contribute to an effective implementation of the 4.0 paradigm.

In the 4.0 context, however, measurement and sensing are often considered just as "tools for generating raw data", which require subsequent processing before being dignified as "information".

This leads to some basic questions: is the role of measurement really that limited? Is it unable to offer anything valuable except for the mere indication of a physical quantity or status?

Starting from these questions, this keynote will introduce the audience to a new perspective on measurement, emphasizing the characterizing and active role that it is going to have in the 4.0 Era. The new perspective stems from the consideration that measurement systems share specific attributes with cyber-physical systems – CPSs, the most complete expression of the integrated use of enabling 4.0 technologies.

Exploiting these similarities and leveraging on the necessary coexistence of measurements in CPSs, measurement and measurement systems in general, can naturally evolve into CPSs. Hence, in the current 4.0 Era scenario, which is witnessing the introduction and development of cyber-physical systems in a number of application contexts, measurement will become a CPS among CPSs. Eventually, the assumed "master-to-slave" relationship between measurement systems and CPSs will turn into a "peer-to-peer" cooperation.

SPEAKER BIO

Leopoldo Angrisani is Full Professor of Electrical and Electronic Measurements with the Department of Information Technology and Electrical Engineering of the University of Naples Federico II, Italy. He is also General Manager/Director of CeSMA – Center of Advanced Measurement and Technology Services and member of the Board of the Ph.D. Program on Information Technology and Electrical Engineering of University of Naples Federico II.

His research activity is currently focused on communication systems and networks test and measurement; measurements for Internet of Things applications; compressive sampling based measurements; measurements for Industry 4.0; measurement uncertainty.

He was and is currently involved in many industrial research projects, in cooperation with small, medium and great enterprises, for which he played and is currently playing the role of scientific coordinator. He is currently playing a relevant role in designing and developing the strategic pillars on which the national Competence Center on Industry 4.0, MedITech, led by Federico II University and geographically located in the South of Italy, is going to be based.

He is Fellow Member of the IEEE Instrumentation and Measurement and Communications Societies, Chair of the IEEE Instrumentation & Measurement Society Italy Chapter, Honorary Chairman of the first edition (M&N 2019) of the IEEE International Symposium on Measurements & Networking 2019, General Chairman of the second edition (MetroInd4.0&IoT 2019) of the IEEE International Workshop on Metrology for Industry 4.0 and IoT 2019. He was one of the promoters of the TC-37 "Measurements and Networking" technical committee of the IEEE Instrumentation & Measurement Society and General Chairman of the first (M&N2011), second (M&N2013), third (M&N2015) and fourth edition (M&N2017) of the IEEE International Workshop on Measurements & Networking. He is Representative of Italy in the IEC Validation Team-VT 60050 for maintenance and management of the International Electrotechnical Vocabulary and member of the Italian Association "GMEE-Electrical and Electronic Measurements

Group", of CNIT, National Inter-university Consortium for Telecommunications, of the Technical Committee CT 1/25 "Terminology, Quantities and Units" of CEI (Italian Electrotechnical Committee).

He is corresponding member of the Accademia Pontaniana in Naples, the oldest Italian academy, with almost 600 years of history, which has always brought together renowned Neapolitan scholars.

In 2009, he was awarded the IET Communications Premium for the paper entitled "Performance measurement of IEEE 802.11b-based networks affected by narrowband interference through cross-layer measurements" (published in IET Communications, vol. 2, No. 1, January 2008).

In 2013, he was awarded the prestigious recognition "IEEE Transactions on Instrumentation and Measurement Outstanding Reviewer".

The IEEE Instrumentation & Measurement Society Italy Chapter, which he has been chairing since 2015, was awarded in 2016 the prestigious recognition "I&M Society Best Chapter Award" by the IEEE Instrumentation & Measurement Society, in 2017 the prestigious recognition "Most Improved Membership Chapter for 2016" and in 2018 the prestigious recognition "Most Innovative Chapter 2018" by the IEEE Italy Section.

He is the author or co-author of more than 300 international scientific articles, one-third of which published in relevant international journals with impact factor.

Plenary Tuesday, June 8, 2021 - H 17:20 CEST

Self-Powered Wearable Sensors for Pervasive Health and Environmental Monitoring

Veena Misra

North Carolina State University, United States

ABSTRACT

Self-powered wearable sensors devices can not only increase adoption and compliance but also enable long-term and continuous monitoring of many key health and environmental parameters. To achieve this, wearable devices must consist of an appropriate array of multimodal sensors, enable non-invasively, continuous and real-time monitoring, have long operational lifetime to gather long-term data and are comfortable and flexible to ensure adoption by the user. Under the national science foundation funded Center for advanced self-powered systems of integrated sensors and technologies (ASSIST), a team of engineers and scientists are building precisely such devices that are capable of continuous monitoring of personal environment and personal health in a continuous/periodic manner. These features are enabled by ASSIST's breakthroughs in power management, low power electronics, low power health

and environmental sensors and smart textiles all integrated into wearable and comfortable form factors. These features will provide continuous monitoring vs. snapshot measurements performed today and eventually enable longitudinal studies of exposure and health since it does not depend on human diligence for its operation. In this talk, I will discuss how these advances are enabling long-term sensing and effective management of chronic conditions, sensing of personal exposure to air pollutants and toxins and provide longitudinal studies that can provide new insight into correlation of various health and environmental parameters. I will also discuss the role that data will play in making these systems effective for both the patient and the provider.

SPEAKER BIO

Veena Misra is the Director of the National Science Foundation Nanosystems Engineering Research Center on Advanced Self-Powered of Integrated Sensors and Technologies (ASSIST). She is a Distinguished Professor of Electrical and Computer Engineering at North Carolina State University and a 2012 IEEE Fellow. She is also a distinguished lecturer for IEEE Sensors. She received the B.S., M.S., and Ph.D. degrees in electrical engineering from North Carolina State University, Raleigh. After working at the Advanced Products Research and Development Laboratories, Motorola Inc., Austin, TX she joined the faculty of North Carolina State University in 1998. She has authored or coauthored over 200 papers. Dr. Misra was the recipient of the 2001 National Science Foundation Presidential Early CAREER Award, the 2011 Alcoa Distinguished Engineering Research Award, and 2007 Outstanding Alumni Research Award and the 2016 R.J. Reynolds Award. She also served as the general chair of the 2012 IEEE International Electron Device Meeting.

Monday, June 7, 2021 - H 17:20 CEST

Inspection for industry 4.0: monitoring based on Brain-Computer Interfaces and Augmented Reality

Pasquale Arpaia, Nicola Moccaldi
University of Naples Federico II, Italy

ABSTRACT

In smart industry, Augmented Reality is one of the nine pillars of the ongoing industrial revolution. In an industrial context, the AR can help several working aspects, from training on-the-job to product design, and maintenance. These operations usually require the user hands to be free from the AR device controller. The combination of AR with a Brain-Computer Interface (BCI) can provide the solution to a hands-free user input, thus providing a novel way of gathering information from the surrounding environment. In this tutorial, a monitoring system integrating AR glasses with BCI is proposed for inspection applications in industry and healthcare. The technical issues addressed in this tutorial aim to show how to build a low-cost non-invasive wearable system for a novel interaction with wireless sensors or electronic devices. For this reason, an overview of current AR technologies is firstly given by highlighting the features of the devices available nowadays, their advantages and disadvantages, and their possible application in smart industry. Then, Brain-Computer Interfaces are introduced, the measurement techniques for brain activity are listed, and a survey of different types of interfaces is presented. Finally, the integration of these two breaking technologies is described.

Tuesday, June 8, 2021 - H 16:20 CEST

Edge AI for IoT applications with MATLAB

Stefano Olivieri
Mathworks

ABSTRACT

Traditionally, most of the processing for IoT applications is being done on a central cloud but that has its issues; which include latency, security, bandwidth, and privacy, etc. A new trend of processing the data on the edge of the network is emerging. The idea is to do processing as near the point of data production as possible. Doing processing on the nodes generating the data is called Edge Computing (EC), where part of the service-specific processing and data storage is moving from the Cloud Computing to the edge network nodes.

If today EC is getting momentum, we're witnessing, at the same time, a growing development of AI (Artificial Intelligence) technologies. In fact, the use of Deep Learning and Machine Learning is becoming pervasive day by day which is opening doors to new opportunities in every aspect of technology.

Edge AI applications are revolutionizing the IoT industry by bringing fast, intelligent behavior to the locations where it is needed. The requirements of these applications seem calling an AI's resources-hungry model, whose cloud-centric execution appears in the opposite direction with a migration of computing, storage and networking resources at the edge. The two technology trends are crossing in the EI (Edge intelligence): an emerging paradigm meeting the challenging requirements of future pervasive services scenarios.

MATLAB offers deep learning functionality for engineering and science workflows. Success goes beyond just developing a deep learning model. Ultimately, models need to be incorporated into an entire system design workflow to deliver a product or a service to the market.

The aim of the session is to provide an overview of how MATLAB can help to take advantage of disruptive technologies like Edge AI and Deep Learning. We will show where deep learning is being applied in engineering and science, and how its driving MATLAB's development. Moreover, we will demonstrate a workflow for how you can research, develop and deploy your own deep learning application.

Wearable Device <Challenge />

Tuesday, June 8, 2021 - H 09:30 CEST

Recent years have seen a rapid increase in the development of smart wearable systems. Such devices are centered around the human body with the aim of making technology as usable and less invasive as possible for the user.

Within this frame, this challenge aim at fostering the development of novel smart wearable devices to enhance the quality of human life by providing reliable and non-invasive measurements about different variables such as respiratory rate, heart activity and temperature to name a few.

Wearable Device Challenge is organized in the framework of the 2021 IEEE International Workshop on Metrology for Internet 4.0 & IoT. IEEE MetroInd4.0&IoT 2021 is with the patronage of Università Campus Bio-Medico di Roma, Sant'Anna School of Advanced Studies - The Biorobotics Institute, University of Brescia and University of Sannio. The competition is opened to all students (BSc, MSc or PhD) who are called to form teams composed by maximum 6 members.

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Program Schedule - June 7, 2021

MONDAY, JUNE 7, 2021			
09:15 - 09:30 CEST	OPENING CEREMONY - WELCOME ADDRESSES		
09:30 - 10:20 CEST	**Plenary Session** - Zero Defect Manufacturing: Integration of Quality Maintenance and Logistics Tullio Tolio, *Politecnico di Milano, Italy*		
	VIRTUAL HALL #1	VIRTUAL HALL #2	VIRTUAL HALL #3
10:30 - 12:10 CEST	**Session 1.1** General Session - Part I	**Session 1.2** Industry 4.0 and IoT for the Hospital of the Future - Part I	**Session 1.3** Measurements and Virtual Measurements for Industry 4.0: Approaches and Solutions for Smart Manufacturing
12:20 - 13:40 CEST	**Session 2.1** Rapid Prototyping of Smart Industrial IoT Solutions	**Session 2.2** Industry 4.0 and IoT for the Hospital of the Future - Part 2	**Session 2.3** Sensors in Smart Objects for IoT Devices in Industry 4.0
13:40 - 14:00 CEST	BREAK		
14:00 - 16:00 CEST	**Session 3.1** Applications of Fiber Optic Sensors in Industry 4.0	**Session 3.2** Sensors and Techniques for Sport and Physical Activity	**H 14:00 - 16:20 - Session 3.3** Intelligence in Infrastructures
16:20 - 17:10 CEST	**Plenary Session** - Challenges of Measuring Human Physical Interaction Neville Hogan, *MIT - Massachusetts Institute of Technology, United States*		
17:20 - 18:10 CEST	**TUTORIAL** - Inspection for industry 4.0: monitoring based on Brain-Computer Interfaces and Augmented Reality Pasquale Arpaia, Nicola Moccaldi - *University of Naples Federico II, Italy*		

Program Schedule - June 8, 2021

TUESDAY, JUNE 8, 2021			
09:00 - 09:50 CEST	**Plenary Session** - Reshaping Measurements in the 4.0 Era Leopoldo Angrisani, *University of Naples Federico II, CeSMA, Italy*		
	VIRTUAL HALL #1	VIRTUAL HALL #2	VIRTUAL HALL #3
10:00 - 11:40 CEST	**Session 4.1** Temperature and Vibration Measurements for Condition-based Maintenance of Machineries	**Session 4.2** Systems and Methods of IoT-Enabled Health Monitoring for the Well-Being Assessment of Operator and Patient 4.0	**Session 4.3** Gender-Inspired Approaches to the Design of Innovative Measurement Systems and IoT Applications
11:50 - 13:10 CEST	**PANEL SESSION** Sensors Foresight - Technology and Market		**11:50 - 14:10 CEST - Session 5.3** Metrology for Data Interoperability in Industry 4.0
13:10 - 14:00 CEST	BREAK		
	VIRTUAL HALL #1	VIRTUAL HALL #2	VIRTUAL HALL #3
14:00 - 16:00 CEST	**Session 6.1** AI-Enhanced Sensing for Industrial and Medical IoT Applications - Part I	**14:00 - 16:20 CEST - Session 6.2** Measurements and Sensors for Safety and Wellness of Workers	**IoT Rapid-Proto Labs: an European transnational opportunity**
16:20 - 17:10 CEST	**TUTORIAL** - Edge AI for IoT applications with MATLAB Stefano Olivieri - *Mathworks*		
17:20 - 18:10 CEST	**Plenary Session** - Self-Powered Wearable Sensors for Pervasive Health and Environmental Monitoring Veena Misra, *North Carolina State University, United States*		

Program Schedule - June 9, 2021

WEDNESDAY, JUNE 9, 2021			
	VIRTUAL HALL #1	VIRTUAL HALL #2	VIRTUAL HALL #3
09:00 - 10:20 CEST	**Session 7.1** Zero Defect Manufacturing - Part I	**Session 7.2** Wearable Sensors and Devices for Unobtrusive Physiological Monitoring - Part I	**Session 7.3** Additive Manufacturing for Industry 4.0
10:30 - 11:50 CEST	**Session 8.1** Zero Defect Manufacturing - Part II	**Session 8.2** Wearable Sensors and Devices for Unobtrusive Physiological Monitoring - Part II	**Session 8.3** General Session - Part II
11:50 - 14:00 CEST	BREAK		
	VIRTUAL HALL #1	VIRTUAL HALL #2	VIRTUAL HALL #3
14:00 - 15:40 CEST	**Session 9.1** Sensors, measurement systems and methods for in-line control, safety and security	**Session 9.2** AI-Enhanced Sensing for Industrial and Medical IoT Applications - Part II	**Session 9.3** Measurement Systems in the Industrial IoT era
15:50 - 17:10 CEST	**Session 10.1** Wireless Solutions for IoT-based Measurements over Wide Areas	**Session 10.2** Measurements and Virtual Measurements for Industry 4.0: Approaches and Solutions for Smart Manufacturing	**Session 10.3** Cybersecurity Standards and Technologies for IoT and Industry 4.0 (SecurityStandards)
17:20 - 17:40 CEST	**CLOSING AND AWARD CEREMONY**		

Technical Sessions - Monday, June 7

09:15 - 09:30
OPENING SESSION – WELCOME ADDRESSES
Room: Virtual Room #1

Prof. Emiliano Schena
IEEE MetroInd2021 General Chair, Università Campus Bio-Medico di Roma, Italy
Prof. Eugenio Guglielmelli
Prorector for Research, Università Campus Bio-Medico di Roma, Italy

09:30 - 10:20 CEST
PLENARY SESSION
Room: Virtual Room #1
Chair: Emilio Sardini, *University of Brescia, Italy*

Zero Defect Manufacturing:
Integration of Quality Maintenance and Logistics
Tullio Tolio, *Politecnico di Milano, Italy*

10:30 - 12:10 CEST
SESSION 1.1
General Session – Part I
Room: Virtual Room #1
Chairs: Francesca De Tommasi, *Università Campus Bio-Medico di Roma, Italy*
Carlo Massaroni, *Università Campus Bio-Medico di Roma, Italy*

10:30 Metrological characterization of a low-cost electroencephalograph for wearable neural interfaces in industry 4.0 applications

Pasquale Arpaia, *Università degli Studi di Napoli Federico II, ARHeMLab, CIRMIS, Italy*
Luca Callegaro, *INRIM - Istituto Nazionale di Ricerca Metrologica, Italy*
Alessandro Cultrera, *INRIM - Istituto Nazionale di Ricerca Metrologica, Italy*
Antonio Esposito, *Politecnico di Torino, ARHeMLab, Italy*
Massimo Ortolano, *Politecnico di Torino, INRIM, Italy*

10:50 LoRa-Based Sensor Node Energy Consumption with Data Compression

Olli Väänänen, *School of Technology JAMK University of Applied Sciences, Finland*
Timo Hämäläinen, *Faculty of Information Technology University of Jyväskylä, Finland*

11:10 State of Health Prediction of Lithium-ion Batteries

Simona Barcellona, *DEIB, Politecnico di Milano, Italy*
Loredana Cristaldi, *DEIB, Politecnico di Milano, Italy*
Marco Faifer, *DEIB, Politecnico di Milano, Italy*
Emil Petkovski, *DEIB, Politecnico di Milano, Italy*
Luigi Piegari, *DEIB, Politecnico di Milano, Italy*
Sergio Toscani, *DEIB, Politecnico di Milano, Italy*

11:30 IOT data-driven experimental process optimisation for kevlar fiberglass components for aeronautic

Giuseppe Mastandrea, *Energy@Work, Italy*
Daniele Mattia, *Energy@Work, Italy*
Luigi D'Oriano, *Energy@Work, Italy*
Giuseppe Rocco Rana, *Energy@Work, Italy*
Francesco Nocera, *Polytechnic University of Bari, Italy*
Marina Mongiello, *Polytechnic University of Bari, Italy*

11:50 Design of a Soft Growing Robot as a Practical Example of Cyber–Physical Measurement Systems

Stanislao Grazioso, *University of Naples Federico II, Italy*
Annarita Tedesco, *University of Bordeaux, France*
Mario Selvaggio, *University of Naples Federico II, Italy*
Stefano Debei, *University of Padova, Italy*
Sebastiano Chiodini, *University of Padova, Italy*
Egidio De Benedetto, *University of Naples Federico II, Italy*
Giuseppe Di Gironimo, *University of Naples Federico II, Italy*
Antonio Lanzotti, *University of Naples Federico II, Italy*

10:30 - 12:10 CEST

SESSION 1.2

SPECIAL SESSION: Industry 4.0 and IoT for the Hospital of the Future - Part I

Room: Virtual Room #2

Chairs: Sergio Silvestri, *University Campus Bio-Medico of Rome, Italy*
Leandro Pecchia, *University of Warwick, UK*

10:30 **An adaptation of Pareto's parametric distribution as a support tool for the analysis of maintenance costs of biomedical equipment**
Vittorio Puntoni, *University Campus Bio-Medico of Rome, Italy*
Grazia Maria Pia Masselli, *University Hospital Campus Bio-Medico of Rome, Italy*
Sergio Silvestri, *University Campus Bio-Medico of Rome, Italy*

10:50 **Instrumented crutches with audio feedback to alter assisted gait**
Marco Ghidelli, *University of Brescia, Italy*
Pietro Padovani, *University of Brescia, Italy*
David Pinto-Fernández, *Spanish National Research Council, Universidad Politécnica de Madrid, Spain*
Simone Pasinetti, *University of Brescia, Italy*
Antonio J. del-Ama, *Rey Juan Carlos University, Spain*
Diego Torricelli, *Spanish National Research Council, Spain*
Matteo Lancini, *University of Brescia, Italy*

11:10 **Forecasting hospital performances using a hybrid ETS-ARIMA algorithm**
Martina Andellini, *Bambino Gesù Children's Hospital, Italy*
Elena Bassanelli, *Bambino Gesù Children's Hospital, Italy*
Francesco Faggiano, *Bambino Gesù Children's Hospital, Italy*
Maria Teresa Esposito, *Bambino Gesù Children's Hospital, Italy*
Selenia Marino, *Bambino Gesù Children's Hospital, Italy*
Matteo Ritrovato, *Bambino Gesù Children's Hospital, Italy*

11:30 **Doppler Flow phantom Stability Assessment through STFT Technique in Medical PW Doppler: a preliminary study**
Giorgia Fiori, *Roma TRE University, Italy*
Fabio Fuiano, *Roma TRE University, Italy*

Andrea Scorza, *Roma TRE University, Italy*
Maurizio Schmid, *Roma TRE University, Italy*
Jan Galo, *IRCCS Children Hospital Bambino Gesù, Italy*
Silvia Conforto, *Roma TRE University, Italy*
Salvatore Andrea Sciuto, *Roma TRE University, Italy*

11:50 Cloxy - An Economical and Scalable SPO2 Tracking System
Asuman Kolbasi, *Boğaziçi University Biomedical Engineering Institute, Turkey*
Aytac Durmaz, *Boğaziçi University Biomedical Engineering Institute, Turkey*
Altay Brusan, *Boğaziçi University Biomedical Engineering Institute, Turkey*
Koksal Kurt, *Pievision Technology, Turkey*
Cengizhan Ozturk, *Boğaziçi University Biomedical Engineering Institute, Turkey*

10:30 - 12:10 CEST

SESSION 1.3

SPECIAL SESSION: Measurements and Virtual Measurements for Industry 4.0: Approaches and Solutions for Smart Manufacturing - PART I

Room: Virtual Room #3

Chairs: Giulio D'Emilia, *University of L'Aquila, Italy*
Antonella Gaspari, *Polytechnic of Bari, Italy*
Emanuela Natale, *University of L'Aquila, Italy*

10:30 Vision system for optical quality control of components made by fibre thermoplastic-based composites
Giulio D'Emilia, *University of L'Aquila, Italy*
Antoniomaria Di Ilio, *University of L'Aquila, Italy*
Antonella Gaspari, *Polytechnic of Bari, Italy*
Emanuela Natale, *University of L'Aquila, Italy*
Antonios G. Stamopoulos, *University of L'Aquila, Italy*
Luciano Chiominto, *University of L'Aquila, Italy*

10:50 Ensemble of artificial neural networks to control the induction soldering of spacecraft's waveguide paths
Anton Milov, *Reshetnev Siberian State University of Science and Technology, Russia*
Vadim Tynchenko, *Reshetnev Siberian State University of Science and Technology, Russia*
Sergei Kurashkin, *Reshetnev Siberian State University of Science and Technology, Russia*
Valeriya Tynchenko, *Reshetnev Siberian State University of Science and Technology, Russia*

11:10 Machine Learning based Prediction Method of Pollution Concentration in the Atmosphere

Kseniya Salakhutdinova, *ITMO University, Russia*
Iuliia Kim, *ITMO University, Russia*
Ilia Viksnin, *ITMO University, Russia*
Vladislav Belyaev, *ITMO University, Russia*
Nikita Tursukov, *ITMO University, Russia*
Evgenii Neverov, *ITMO University, Russia*
Irina Krivtsova, *ITMO University, Russia*

11:30 Assembly Error-mating Measurement and Compensation Method for Machining Production Line

Shih-Ming Wang, *National Chung Hsing University, Taiwan*
Ren-Qi Tu, *Chung Yuan Christian University, Taiwan*
Hariyanto Gunawan, *Chung Yuan Christian University, Taiwan*

11:50 Development of Eddy Current Sensor for Measuring Thickness of Copper Wafer in sub-Micron Scale

Eungchul Kim, *Sungkyunkwan University, Republic of Korea*
Seungjun Oh, *Sungkyunkwan University, Republic of Korea*
Taesung Kim, *Sungkyunkwan University, Republic of Korea*

12:20 - 13:40 CEST
SESSION 2.1
SPECIAL SESSION: Rapid Prototyping of Smart Industrial IoT Solutions
Room: Virtual Room #1
Chairs: Davide Brunelli, *University of Trento, Italy*
Elisabetta Farella, *Fondazione Bruno Kessler, Italy*

12:20 Non-Invasive Air-Writing Using Deep Neural Network

Matteo Perotto, *University of Trento, Italy*
Luca Gemma, *University of Trento, Italy*
Davide Brunelli, *University of Trento, Italy*

12:40 Preliminary study of an innovative method to increase the accuracy in direct 3D-Printing of NURBS objects

Francesca Bertacchini, *University of Calabria, Italy*
Eleonora Bilotta, *University of Calabria, Italy*
Domenico Luca Carnì, *University of Calabria, Italy*
Francesco Demarco, *University of Calabria, Italy*
Pietro Pantano, *University of Calabria, Italy*
Carmelo Scuro, *University of Calabria, Italy*
Francesco Lamonaca, *University of Calabria, Italy*

13:00 Preventing COVID-19 contagion in industrial environments through anonymous contact tracing

Matteo Nardello, *University of Trento, Italy*
Luca Santoro, *University of Trento, Italy*
Francesco Pilati, *University of Trento, Italy*
Davide Brunelli, *University of Trento, Italy*

13:20 Damage Detection in Structural Health Monitoring with Spiking Neural Networks

Luca Zanatta, *University of Bologna, Italy*
Francesco Barchi, *University of Bologna, Italy*
Alessio Burrello, *University of Bologna, Italy*
Andrea Bartolini, *University of Bologna, Italy*
Davide Brunelli, *University of Trento, Italy*
Andrea Acquaviva, *University of Bologna, Italy*

12:20 - 13:40 CEST

SESSION 2.2

SPECIAL SESSION: Industry 4.0 and IoT for the Hospital of the Future - Part I

Room: Virtual Room #2

Chairs: Sergio Silvestri, *University Campus Bio-Medico of Rome, Italy*
Leandro Pecchia, *University of Warwick, UK*

12:20 Structural integrity monitoring of the endoscopes working channels: a visual inspection approach

Maria Stella Ricci, *University Campus Bio-Medico of Rome, Italy*
Andrea Lozupone, *University Campus Bio-Medico of Rome, Italy*
Benedetta Colombo, *University Hospital Campus Bio-Medico of Rome, Italy*
Francesco Maria Di Matteo, *University Hospital Campus Bio-Medico of Rome, Italy*
Sergio Silvestri, *University Campus Bio-Medico of Rome, Italy*

12:40 A novel experimental set-up for Young Modulus Assessment through Transit Time measurements in Biomedical applications

Fabio Fuiano, *Roma TRE University, Italy*
Giorgia Fiori, *Roma TRE University, Italy*
Andrea Scorza, *Roma TRE University, Italy*
Salvatore Andrea Sciuto, *Roma TRE University, Italy*

13:00 A vest for treating jaundice in low-resource settings

Davide Piaggio, *University of Warwick, UK*
Martina Andellini, *University of Warwick, UK*
Mahir Taher, *University of Warwick, UK*
Leandro Pecchia, *University of Warwick, UK*

13:20 Intraoperative-technologies advancements in automated cancer detection: a narrative review

Giulia Fransvea, *Industry 4.0 Competence Center, ARTES4.0, Italy*
Sara Moccia, *Scuola Superiore Sant'Anna, Italy*
Federico Bianchi, *Industry 4.0 Competence Center, ARTES4.0, Italy*
Gastone Ciuti, *Scuola Superiore Sant'Anna, Italy*
Arianna Menciassi, *Scuola Superiore Sant'Anna, Italy*
Lorenzo Capineri, *Università degli Studi di Firenze, Italy*
Calogero Maria Oddo, *Scuola Superiore Sant'Anna, Italy*

12:20 - 13:40 CEST

SESSION 2.3

SPECIAL SESSION: Sensors in Smart Objects for IoT Devices in Industry 4.0

Room: Virtual Room #3

Chairs: Michela Borghetti, *University of Brescia, Italy*
Salvatore Castorina, *University of Catania, Italy*

12:20 An Integrated Platform of Smart Objects Supporting the Quality of Life of Frail People

Bruno Andò, *University of Catania, Italy*
Salvatore Baglio, *University of Catania, Italy*
Luciano Cantelli, *University of Catania, Italy*
Salvatore Castorina, *University of Catania, Italy*
Ruben Crispino, *University of Catania, Italy*
Carl J. Debono, *University of Malta, Malta*
Dario C. Guastella, *University of Catania, Italy*
Vincenzo Marletta, *University of Catania, Italy*
Giovanni Muscato, *University of Catania, Italy*
Giuseppe Sutera, *University of Catania, Italy*
Matthew Sacco, *University of Malta, Malta*
Andrea Borgese, *University of Catania, Italy*

12:40 Preliminary Analysis on a Paper-based Ammonia Sensor for Future Food Smart Packaging

Michela Borghetti, *University of Brescia, Italy*
Edoardo Cantù, *University of Brescia, Italy*
Emilio Sardini, *University of Brescia, Italy*
Mauro Serpelloni, *University of Brescia, Italy*
Andrea Ponzoni, *National Research Council, University of Brescia, Italy*

13:00 Batteryless Wireless Temperature/Humidity Sensor for Item-level Smart Pharma Packaging

Nicola D'Uva, *Radio6ense srl, Italy*
Francesca Camera, *University of Rome Tor Vergata, Italy*
Sara Amendola, *Radio6ense srl, University of Rome Tor Vergata, Italy*
Simone Nappi, *Radio6ense srl, University of Rome Tor Vergata, Italy*
Carolina Miozzi, *Radio6ense srl, University of Rome Tor Vergata, Italy*
Cecilia Occhiuzzi, *Radio6ense srl, University of Rome Tor Vergata, Italy*
Gaetano Marrocco, *Radio6ense srl, University of Rome Tor Vergata, Italy*

13:20 Preliminary Study on Wireless Passive Resistive Sensor Applied for Smart Objects

Michela Borghetti, *University of Brescia, Italy*
Edoardo Cantù, *University of Brescia, Italy*
Emilio Sardini, *University of Brescia, Italy*
Mauro Serpelloni, *University of Brescia, Italy*

14:00 - 16:00 CEST

SESSION 3.1

SPECIAL SESSION: Applications of Fiber Optic Sensors in Industry 4.0

Room: Virtual Room #1

Chairs: Daniela Lo Presti, *Università Campus Bio-Medico di Roma, Italy*
Cátia Leitão, *University of Aveiro, Portugal*
Daniele Tosi, *Nazarbayev University, Kazakhstan*
Taesung Kim, *School of Mechanical Engineering, South Korea*

14:00 Temperature Monitoring by Fiber Bragg Gratings during Microwave Ablation of Ex Vivo Organs for Heat Sink Effect Assessment

Elena De Vita, *University of Naples "Parthenope", Italy*
Francesca De Tommasi, *Università Campus Bio-Medico di Roma, Italy*
Carlo Massaroni, *Università Campus Bio-Medico di Roma, Italy*
Agostino Iadicicco, *University of Naples "Parthenope", Italy*
Eliodoro Faiella, *Università Campus Bio-Medico di Roma, Italy*
Massimiliano Carassiti, *Università Campus Bio-Medico di Roma, Italy*
Rosario Francesco Grasso, *Università Campus Bio-Medico di Roma, Italy*
Emiliano Schena, *Università Campus Bio-Medico di Roma, Italy*
Stefania Campopiano, *University of Naples "Parthenope", Italy*

14:20 SiC and Diamond Membrane Based Pressure Sensors for Harsh Environments

Andrea Orsini, *"Niccolò Cusano" University, Italy*
Sara Pettinato, *"Niccolò Cusano" University, Italy*
Daniele Barettin, *"Niccolò Cusano" University, Italy*
Armando Piccardi, *"Niccolò Cusano" University, Italy*
Gennaro Salvatore Ponticelli, *"Niccolò Cusano" University, Italy*
Stefano Salvatori, *"Niccolò Cusano" University, Italy*

14:40 Feasibility assessment of an FBG-based soft sensor embedded into a single-use surgical mask for respiratory monitoring

Daniela Lo Presti, *Università Campus Bio-Medico di Roma, Italy*
Martina Zaltieri, *Università Campus Bio-Medico di Roma, Italy*
Rosaria D'amato, *ENEA Research Center of Frascati, Italy*
Michele Caponero, *ENEA Research Center of Frascati, Italy*
Carlo Massaroni, *Università Campus Bio-Medico di Roma, Italy*
Emiliano Schena, *Università Campus Bio-Medico di Roma, Italy*

15:00 FBG-based System for Loss of Resistance Detection During Epidural Injections

Francesca De Tommasi, *Università Campus Bio-Medico di Roma, Italy*
Daniela Lo Presti, *Università Campus Bio-Medico di Roma, Italy*
Carlo Massaroni, *Università Campus Bio-Medico di Roma, Italy*
Emiliano Schena, *Università Campus Bio-Medico di Roma, Italy*
Massimiliano Carassiti, *Università Campus Bio-Medico di Roma, Italy*

15:20 Unobtrusive monitoring of the respiratory rate in an office desk chair with FBG sensors

Diogo Prata, *University of Aveiro, Portugal*
Alexandre Carvalho, *University of Aveiro, Portugal*
Florinda M. Costa, *University of Aveiro, Portugal*
Carlos Marques, *University of Aveiro, Portugal*
Cátia Leitão, *University of Aveiro, Portugal*

15:40 FBGs in 3D printed objects monitoring

Pasquale Di Palma, *University of Naples "Parthenope", Italy*
Agostino Iadicicco, *University of Naples "Parthenope", Italy*
Stefania Campopiano, *University of Naples "Parthenope", Italy*

14:00 - 16:00 CEST

SESSION 3.2

SPECIAL SESSION: Sensors and Techniques for Sport and Physical Activity

Room: Virtual Room #2

Chairs: Andrea Nicolò, *University of Rome "Foro Italico", Italy*
Elena Bergamini, *University of Rome "Foro Italico", Italy*
Carlo Massaroni, *Università Campus Bio-Medico di Roma, Italy*

14:00 Ballistic skills assessment in semi-professional football players through inertial sensors: the effects of COVID-19 forced rest period

Luigi Truppa, *Scuola Superiore Sant'Anna, Italy*
Lorenzo Nuti, *Università di Pisa, Italy*
Stefano Mazzoleni, *Politecnico di Bari, Italy*
Pietro Garofalo, *TuringSense EU Lab, Italy*
Andrea Mannini, *Scuola Superiore Sant'Anna, Italy*

14:20 SISTINE: Sensorized Socks for Telemonitoring of Vascular Disease Patients

Leandro Lucangeli, *Technoscience, University of Rome "Foro Italico", Italy*
Emanuele D'Angelantonio, *Technoscience, University of Rome "Roma Tre", Italy*
Valentina Camomilla, *IuC-BoHNeS, University of Rome "Foro Italico", Italy*
Antonio Pallotti, *Technoscience, University of Rome "Tor Vergata", Italy*

14:40 Step count accuracy and precision of the Xiaomi Mi Smart Band 5 in healthy young individuals

Alessio Bellini, *University of Rome "Foro Italico", Italy*
Andrea Nicolò, *University of Rome "Foro Italico", Italy*
Amaranta Soledad Orejel Bustos, *University of Rome "Foro Italico", Italy*
Massimo Sacchetti, *University of Rome "Foro Italico", Italy*

15:00 The rationale behind the Technogym Functional Threshold Power test

Andrea Nicolò, *University of Rome "Foro Italico", Italy*
Silvano Zanuso, *Technogym Scientific Department, Italy, Edith Cowan University, Australia*
Luca Zoffoli, *Technogym Scientific Department, Italy, University of Padova, Italy*
Massimo Sacchetti, *University of Rome "Foro Italico", Italy*

15:20 Entrainment between music and breathing during cycling exercise: a pilot study

Lorenzo Innocenti, *University of Rome "Foro Italico", Italy*
Andrea Nicolò, *University of Rome "Foro Italico", Italy*
Carlo Massaroni, *Università Campus Bio-Medico di Roma, Italy*
Massimo Sacchetti, *University of Rome "Foro Italico", Italy*

15:40 Polymer-encapsulated flexible strain sensors to monitor scapular movement: a pilot study

Arianna Carnevale, *Università Campus Bio-Medico di Roma, Italy*
Joshua Di Tocco, *Università Campus Bio-Medico di Roma, Italy*
Carlo Massaroni, *Università Campus Bio-Medico di Roma, Italy*
Umile Giuseppe Longo, *Università Campus Bio-Medico di Roma, Italy*
Emiliano Schena, *Università Campus Bio-Medico di Roma, Italy*
Vincenzo Denaro, *Università Campus Bio-Medico di Roma, Italy*

14:00 - 16:20 CEST

SESSION 3.3

SPECIAL SESSION: Intelligence in Infrastructures

Room: Virtual Room #3

Chair: Alessandro Massaro, *Dyrecta Lab srl, Italy*

14:00 CNN-LSTM Neural Network Applied for Thermal Infrared Underground Water Leakage

Alessandro Massaro, *Dyrecta Lab srl, Italy*
Antonio Panarese, *Dyrecta Lab srl, Italy*
Sergio Selicato, *Dyrecta Lab srl, Italy*
Angelo Galiano, *Dyrecta Lab srl, Italy*

14:20 Technological Platform for Hydrogeological Risk Computation and Water Leakage Detection based on a Convolutional Neural Network

Alessandro Massaro, *Dyrecta Lab srl, Italy*
Antonio Panarese, *Dyrecta Lab srl, Italy*
Angelo Galiano, *Dyrecta Lab srl, Italy*

14:40 Intelligent Inspection of Railways Infrastructure and Risks Estimation by Artificial Intelligence Applied on Noninvasive Diagnostic Systems

Alessandro Massaro, *Dyrecta Lab srl, Italy*
Giovanni Dipierro, *Dyrecta Lab srl, Italy*
Sergio Selicato, *Dyrecta Lab srl, Italy*
Emanuele Cannella, *Dyrecta Lab srl, Italy*
Angelo Galiano, *Dyrecta Lab srl, Italy*
Annamaria Saponaro, *Dyrecta Lab srl, Italy*

15:00 Railway Components Wear: a Smart Platform for Full Traceability of Maintenance Activities

Alessandro Massaro, *Dyrecta Lab srl, Italy*
Emanuele Cannella, *Dyrecta Lab srl, Italy*
Sergio Selicato, *Dyrecta Lab srl, Italy*
Giovanni Dipierro, *Dyrecta Lab srl, Italy*
Annamaria Saponaro, *Dyrecta Lab srl, Italy*
Maria Giovanna Trotta, *Dyrecta Lab srl, Italy*
Angelo Galiano, *Dyrecta Lab srl, Italy*

15:20 Intelligent Quarry Production Monitoring Risks and Quality by Artificial Intelligence

Alessandro Massaro, *Dyrecta Lab srl, Italy*
Giovanni Dipierro, *Dyrecta Lab srl, Italy*
Sergio Selicato, *Dyrecta Lab srl, Italy*
Emanuele Cannella, *Dyrecta Lab srl, Italy*
Angelo Galiano, *Dyrecta Lab srl, Italy*
Annamaria Saponaro, *Dyrecta Lab srl, Italy*

15:40 Thermal IR and GPR UAV and Vehicle Embedded Sensor Non-Invasive Systems for Road and Bridge Inspections

Alessandro Massaro, *Dyrecta Lab srl, Italy*
Nicola Savino, *Dyrecta Lab srl, Italy*
Sergio Selicato, *Dyrecta Lab srl, Italy*
Antonio Panarese, *Dyrecta Lab srl, Italy*
Angelo Galiano, *Dyrecta Lab srl, Italy*
Giovanni Dipierro, *Dyrecta Lab srl, Italy*

16:00 A Non-Intrusive Load Identification System Based on Frequency Response Analysis

Giovanni Bucci, *University of L'Aquila, Italy*
Fabrizio Ciancetta, *University of L'Aquila, Italy*
Edoardo Fiorucci, *University of L'Aquila, Italy*
Simone Mari, *University of L'Aquila, Italy*
Andrea Fioravanti, *University of L'Aquila, Italy*

16:20 - 17:10 CEST

PLENARY SESSION

Room: Virtual Room #1

Chair: Domenico Formica, *Univesità Campus Bio-Medico di Roma, Italy*

Challenges of Measuring Human Physical Interaction

Neville Hogan, *MIT - Massachusetts Institute of Technology, United States*

17:20 - 18:10 CEST

TUTORIAL - SESSION 1

Room: Virtual Room #1

Chair: Eduardo Palermo, *Sapienza University of Roma, Italy*

Inspection for industry 4.0: monitoring based on Brain-Computer Interfaces and Augmented Reality

Pasquale Arpaia, Nicola Moccaldi - *University of Naples Federico II, Italy*

Technical Sessions - Tuesday, June 8

09:00 - 09:50 CEST

PLENARY SESSION

Room: Virtual Room #1

Chair: Calogero Maria Oddo, *Scuola Superiore Sant'Anna, Pisa, Italy*

Reshaping Measurements in the 4.0 Era

Leopoldo Angrisani, *University of Naples Federico II, CeSMA, Italy*

10:00 - 11:40 CEST

SESSION 4.1

SPECIAL SESSION: Temperature and Vibration Measurements for Condition-based Maintenance of Machineries

Room: Virtual Room #1

Chair: Marco Tarabini, *Politecnico di Milano, Italy*

10:00 **Vibration Signals for Condition Based Maintenance of Hydraulic Valves**

Fabio Conti, *Politecnico di Milano, Italy*
Chiara Conese, *Politecnico di Milano, Italy*
Maurizio Colombo, *One-Off Solution - Automation Software Services, Italy*
Luca Maggioni, *Politecnico di Milano, Italy*
Giovanni Moschioni, *Politecnico di Milano, Italy*
Marco Tarabini, *Politecnico di Milano, Italy*

10:20 **Turbomolecular high-vacuum pump bearings diagnostics using temperature and vibration measurements**

Alessandro Paolo Daga, *Politecnico di Torino, Italy*
Luigi Garibaldi, *Politecnico di Torino, Italy*
Luca Bonmassar, *Agilent Technologies Italia Spa, Italy*

10:40 Vibration Analysis for Condition Monitoring of an Automatic Press Machine for Thermoplastic Polymers

Chiara Conese, *Politecnico di Milano, Italy*
Fabio Conti, *Politecnico di Milano, Italy*
Simone Cinquemani, *Politecnico di Milano, Italy*
Francesco Morgan Bono, *Politecnico di Milano, Italy*
Alessandro Zavalloni, *GDM SpA, Italy*
Marco Tarabini, *Politecnico di Milano, Italy*

11:00 A Case Study on Challenges of Applying Machine Learning for Predictive Drill Bit Sharpness Estimation

Umut Onus, *IMMS GmbH, Germany*
Stefan Marr, *GFE, Germany*
Sebastian Uziel, *IMMS GmbH, Germany*
Silvia Krug, *IMMS GmbH, Germany*

11:20 Characterization of a 6 Degrees of Freedom Parallel Robot

Hermes Giberti, *Università degli Studi di Pavia, Italy*
Francesco La Mura, *Università degli Studi di Pavia, Italy*
Marco Tarabini, *Politecnico di Milano, Italy*
Mattia Camnasio, *Todeschini Mario s.r.l., Italy*

10:00 - 11:40 CEST

SESSION 4.2

SPECIAL SESSION: Systems and Methods of IoT-Enabled Health Monitoring for the Well-Being Assessment of Operator and Patient 4.0

Room: Virtual Room #2

Chairs: Susanna Spinsante, *Università Politecnica delle Marche, Italy*
Grazia Iadarola, *University of Sannio, Italy*
Gloria Cosoli, *Università Politecnica delle Marche, Italy*
Angelica Poli, *Università Politecnica delle Marche, Italy*

10:00 2D ECG Image Based Biometric Identification Using Stacked Autoencoders

Mohamed Benouis, *M'sila University, Algeria*
Meriem Reguide, *University Ferhat Abbas Setif 1, Algeria*
Alfredo Rosado-Munoz, *University of Valencia, Spain*
Lotfi Mostefai, *Dr Moulay Tahar University of Saida, Algeria*

10:20 AI-based sensor network for ADLs monitoring on ageing people during COVID-19 epidemic

Sara Casaccia, *Università Politecnica delle Marche, Italy*
Gian Marco Revel, *Università Politecnica delle Marche, Italy*
Lorenzo Scalise, *Università Politecnica delle Marche, Italy*

10:40 Baropodometric analysis in different feet positions: reliability and repeatability evaluation

Luca Molinaro, *University of Tuscia, Motustech, Italy*
Juri Taborri, *University of Tuscia, Italy*
Stefano Rossi, *University of Tuscia, Italy*

11:00 Two-dimensional temperature feedback control strategy for thermal ablation of biological tissue

Leonardo Bianchi, *Politecnico di Milano, Italy*
Annalisa Orrico, *Politecnico di Milano, Italy*
Sanzhar Korganbayev, *Politecnico di Milano, Italy*
Martina De Landro, *Politecnico di Milano, Italy*
Paola Saccomandi, *Politecnico di Milano, Italy*

11:20 Learning classifiers for analysis of Blood Volume Pulse signals in IoT-enabled systems

Gloria Cosoli, *Marche Polytechnic University, Italy*
Grazia Iadarola, *University of Sannio, Italy*
Angelica Poli, *Marche Polytechnic University, Italy*
Susanna Spinsante, *Marche Polytechnic University, Italy*

10:00 - 11:40 CEST

SESSION 4.3

SPECIAL SESSION: Gender-Inspired Approaches to the Design of Innovative Measurement Systems and IoT Applications

Room: Virtual Room #3

Chairs: Paola Saccomandi, *Politecnico di Milano, Italy*
Cristina Emilia Costa, *Fondazione Bruno Kessler, Italy*
Monica La Mura, *University of Salerno, Italy*
Dajana Cassioli, *University of L'Aquila, Italy*
Patrizia Lamberti, *University of Salerno, Italy*

10:00 User-driven design and monitoring systems of limb prostheses: overview on the technology and on the gender-related aspects

Yumeng Yao, *University of Shanghai for Science and Technology, China, Politecnico di Milano, Italy*
Paola Saccomandi, *Politecnico di Milano, Italy*
Marco Tarabini, *Politecnico di Milano, Italy*

10:20 Chroma. A bioinspired medical solution for pregnancy care

Carla Langella, *University of Campania "Luigi Vanvitelli", Italy*
Valentina Perricone, *University of Campania "Luigi Vanvitelli", Italy*
Daria Cermola, *University of Campania "Luigi Vanvitelli", Italy*
Flavia Mastroberardino, *University of Campania "Luigi Vanvitelli", Italy*
Roberta Gragnano, *University of Campania "Luigi Vanvitelli", Italy*
Giovanni Di Palma, *Presidio Ospedaliero Busto – Arsizio, Italy*

10:40 Fighting maternal bleeding in low-resource settings: an analysis of design and measurement issues

Sara Candidori, *Politecnico di Milano, Italy*
Francesco De Gaetano, *Politecnico di Milano, Italy*
Kasra Osouli, *Politecnico di Milano, Italy*
Adriana Re, *Politecnico di Milano, Italy*
Paolo Volonté, *Politecnico di Milano, Italy*
Alberto Antonio Zanini, *Freelance professional*
Serena Graziosi, *Politecnico di Milano, Italy*
Maria Laura Costantino, *Politecnico di Milano, Italy*

11:00 Preliminary analysis on the cervicothoracic angular velocity during forward bending and backward return task

Davide Paloschi, *Politecnico di Milano, Italy*
Marco Bravi, *Università Campus Bio-Medico di Roma, Italy*
Sandra Miccinilli, *Università Campus Bio-Medico di Roma, Italy*
Emiliano Schena, *Università Campus Bio-Medico di Roma, Italy*
Silvia Sterzi, *Università Campus Bio-Medico di Roma, Italy*
Carlo Massaroni, *Università Campus Bio-Medico di Roma, Italy*
Paola Saccomandi, *Politecnico di Milano, Italy*

11:20 A 3D printed human skin phantom made of multifunctional nanocomposites for the assessment of RF treatments effect

Patrizia Lamberti, *University of Salerno, Italy*
Luca Melillo, *University of Salerno, Italy*
Monica La Mura, *University of Salerno, Italy*
Rumiana Kotsilkova, *Bulgarian Academy of Sciences, Bulgaria*
Vladimir Georgiev, *Bulgarian Academy of Sciences, NanoTechLab Ltd., Bulgaria*
Vincenzo Tucci, *University of Salerno, Italy*

11:50 - 13:10
PANEL SESSION
Sensors Foresight - Technology and Market
Room: Virtual Room #1
Chair: Marco Tarabini, *Politecnico di Milano, Italy*

11:50 - 14:10 CEST

SESSION 5.3

SPECIAL SESSION: Metrology for Data Interoperability in Industry 4.0

Room: Virtual Room #3

Chairs: Blair Hall, *Measurement Standards Laboratory of New Zealand, New Zealand*
Sascha Eichstädt, *Physikalisch-Technische Bundesanstalt, Germany*
Mark Kuster, *Consultant*
Michael Schwartz, *CalLab Solutions*

11:50 Considerations about quantities, units, and dimensions for interoperability
Blair Hall, *Measurement Standards Laboratory of New Zealand, New Zealand*

12:10 Interoperable processes and infrastructure for the digital transformation of the quality infrastructure
Anke Keidel, *Physikalisch-Technische Bundesanstalt, Germany*
Sascha Eichstädt, *Physikalisch-Technische Bundesanstalt, Germany*

12:30 Benefits of network effects and interoperability for the digital calibration certificate management
Juho Nummiluikki, *Aalto University School of Engineering, Finland*
Tuukka Mustapää, *Aalto University School of Engineering, Finland*
Katri Hietala, *Aalto University School of Engineering, Finland*
Raine Viitala, *Aalto University School of Engineering, Finland*

12:50 Semantics in Sensor Networks: An Ontology for Dynamic Transfer Behavior in Calibrated Sensors
Anupam Prasad Vedurmudi, *Physikalisch-Technische Bundesanstalt, Germany*
Maximilian Gruber, *Physikalisch-Technische Bundesanstalt, Germany*
Sascha Eichstädt, *Physikalisch-Technische Bundesanstalt, Germany*
Adrian Paschke, *Freie Universität Berlin, Fraunhofer FOKUS, Germany*

13:10 SmartCom - Key Findings for Digitalisation in Metrology
Wiebke Heeren, *Physikalisch-Technische Bundesanstalt, Germany*
Bernd Müller, *Ostfalia University of Applied Sciences, Germany*
Gianfranco Miele, *University of Cassino and Southern Lazio, Italy*
Tuukka Mustapää, *Aalto University School of Engineering, Finland*
Daniel Hutzschenreuter, *Physikalisch-Technische Bundesanstalt, Germany*
Clifford Brown, *Physikalisch-Technische Bundesanstalt, Germany*
Oksana Baer, *Physikalisch-Technische Bundesanstalt, Germany*

13:30 Decreasing the implementation costs of smart metering systems with interoperability

Jovan Vujasinović, *University of Belgrade, Serbia*
Goran Savić, *University of Belgrade, Serbia*
Ilija Batas - Bjelic, *Institute of Technical Sciences of the Serbian Academy of Sciences and Arts, Serbia*
Nikola Rajaković, *University of Belgrade, Serbia*

13:50 Metrological Data Completeness for Digital Transformation

Mark Kuster, *Consultant*

14:00 - 16:00 CEST

SESSION 6.1

SPECIAL SESSION: AI-Enhanced Sensing for Industrial and Medical IoT Applications - Part I

Room: Virtual Room #1

Chairs: Luca Vollero, *University Campus Bio-Medico of Rome, Italy*
Samuel Oluwarotimi Williams, *Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, China*

14:00 A Low Channel Number Sensing Approach for an Ethnic Specific Labour Immanency Prediction using Bio-Electromagnetism

Ejay Nsugbe, *Independent Researcher*
Ibrahim Sanusi, *University of Sheffield, UK*
Olusayo Obajemu, *Fredericton, Canada*
Oluwarotimi Williams Samuel, *Chinese Academy of Sciences, China*
Mojisola Grace Asogbon, *Chinese Academy of Sciences, China*
Guanglin Li, *Chinese Academy of Sciences, China*

14:20 A Machine Learning-based Approach for Advanced Monitoring of Automated Equipment for the Entertainment Industry

Michele Berno, *University of Padua, Italy*
Marco Canil, *University of Padua, Italy*
Nicola Chiarello, *University of Padua, Italy*
Luca Piazzon, *University of Padua, Italy*

Fabio Berti, *Antonio Zamperla S.p.A., Italy*
Francesca Ferrari, *Antonio Zamperla S.p.A., Italy*
Alessandro Zaupa, *Antonio Zamperla S.p.A., Italy*
Nicola Ferro, *University of Padua, Italy*
Michele Rossi, *University of Padua, Italy*
Gian Antonio Susto, *University of Padua, Italy*

14:40 Image sensors and VPU acceleration for data analysis and classification
Lorenzo Petrosino, *Università Campus Bio-Medico di Roma, Italy*
Giulio Iannello, *Università Campus Bio-Medico di Roma, Italy*
Mario Merone, *Università Campus Bio-Medico di Roma, Italy*
Luca Vollero, *Università Campus Bio-Medico di Roma, Italy*

15:00 Edge computing optimization method. Analyzed task: crowd counting
Alessandro Graziosi, *Università Campus Bio-Medico di Roma, Italy*
Giulio Iannello, *Università Campus Bio-Medico di Roma, Italy*
Valerio Lapadula, *Università Campus Bio-Medico di Roma, Italy*
Mario Merone, *Università Campus Bio-Medico di Roma, Italy*
Marco Sabatini, *Università Campus Bio-Medico di Roma, Italy*
Luca Vollero, *Università Campus Bio-Medico di Roma, Italy*

15:20 Heart Rate Analysis through Smartphone Camera
Anna Sabatini, *Università Campus Bio-Medico di Roma, Italy*
Giulio Iannello, *Università Campus Bio-Medico di Roma, Italy*
Giorgio Pennazza, *Università Campus Bio-Medico di Roma, Italy*
Marco Santonico, *Università Campus Bio-Medico di Roma, Italy*
Mariassunta Spinosa, *Università Campus Bio-Medico di Roma, Italy*
Luca Vollero, *Università Campus Bio-Medico di Roma, Italy*

15:40 A Machine Learning-Based Voice Analysis for the Detection of Dysphagia Biomarkers
Valerio Cesarini, *University of Rome Tor Vergata, Italy*
Niccoló Casiddu, *University of Genoa, Italy*
Claudia Porfirione, *University of Genoa, Italy*
Giulia Massazza, *University of Genoa, Italy*
Giovanni Saggio, *University of Rome Tor Vergata, Italy*
Giovanni Costantini, *University of Rome Tor Vergata, Italy*

14:00 - 16:20 CEST

SESSION 6.2

SPECIAL SESSION: Measurements and Sensors for Safety and Wellness of Workers

Room: Virtual Room #2

Chairs: Carla Fanizza, *DITSPIA, INAIL, Italy*
Maria Sabrina Sarto, *DIAEE, CNIS, Sapienza University of Rome, Italy*
Marco Di Rienzo, *IRCCS Fondazione Don Carlo Gnocchi, Italy*
Enzo Pasquale Scilingo, *University of Pisa, Italy*
Fabio Di Francesco, *University of Pisa, Italy*
Maurizio Ferrarin, *IRCCS Fondazione Don Carlo Gnocchi, Italy*
Antonio Lanatà, *University of Florence, Italy*
Calogero Maria Oddo, *Scuola Superiore Sant'Anna, Pisa, Italy*
Emiliano Schena, *Università Campus Bio-Medico di Roma, Italy*

14:00 Radar-Based Monitoring of the Worker Activities by Exploiting Range-Doppler and Micro-Doppler Signatures
Emanuele Cardillo, *University of Messina, Italy*
Changzhi Li, *Texas Tech University, USA*
Alina Caddemi, *University of Messina, Italy*

14:20 Initial evaluation of a portable ultrasound exposimeter for occupational health monitoring
Michal Cieslak, *Physikalisch-Technische Bundesanstalt, Germany*
Christoph Kling, *Physikalisch-Technische Bundesanstalt, Germany*
Andrea Wolff, *Institut fur Arbeitsschutz der Deutschen Gesetzlichen Unfallversicherung, Germany*

14:40 Analysis of Physiological Parameters and Workload during Working Tasks in COVID-19 Pandemic Conditions
Christian Tamantini, *Università Campus Bio-Medico di Roma, Italy*
Martina Lapresa, *Università Campus Bio-Medico di Roma, Italy*
Francesco Scotto di Luzio, *Università Campus Bio-Medico di Roma, Italy*
Francesca Cordella, *Università Campus Bio-Medico di Roma, Italy*
Loredana Zollo, *Università Campus Bio-Medico di Roma, Italy*

15:00 Architecture of a Wireless Wearable Body Area Sensor Network for Work Risk Assessment

Stefano Di Modica, *University of Pisa, Italy*
Marco Di Rienzo, *Fondazione Don Carlo Gnocchi, Italy*
Fabio Di Francesco, *University of Pisa, Italy*
Enzo Pasquale Scilingo, *University of Pisa, Italy*
Antonio Lanata, *University of Florence, Italy*

15:20 A clustering-based approach for quality level verification of sanitation procedures in workplaces

Francesca Santucci, *Università Campus Bio-Medico di Roma, Italy*
Luca Faramondi, *Università Campus Bio-Medico di Roma, Italy*
Roberto Setola, *Università Campus Bio-Medico di Roma, Italy*
Marco Massenzi, *Teleconsys S.p.A, Italy*
Francesco Orlando, *Teleconsys S.p.A, Italy*

15:40 Respiratory rate monitoring of video terminal operators based on fiber optic technology

Daniela Lo Presti, *Università Campus Bio-Medico di Roma, Italy*
Martina Zaltieri, *Università Campus Bio-Medico di Roma, Italy*
Joshua Di Tocco, *Università Campus Bio-Medico di Roma, Italy*
Carlo Massaroni, *Università Campus Bio-Medico di Roma, Italy*
Giacomo D'Alesio, *Scuola Superiore Sant'Anna, Italy*
Jessica D'Abbraccio, *Scuola Superiore Sant'Anna, Italy*
Mariangela Filosa, *Scuola Superiore Sant'Anna, Italy*
Calogero Oddo, *Scuola Superiore Sant'Anna, Italy*
Maria Chiara Carrozza, *Scuola Superiore Sant'Anna, Italy*
Maurizio Ferrarin, *IRCCS Fondazione Don Carlo Gnocchi, Italy*
Marco Di Rienzo, *IRCCS Fondazione Don Carlo Gnocchi, Italy*
Emiliano Schena, *Università Campus Bio-Medico di Roma, Italy*

16:00 Enhancing joint torque estimation of the workers using 3D body models

Teodorico Caporaso, *University of Naples Federico II, Italy*
Stanislao Grazioso, *University of Naples Federico II, Italy*
Dario Panariello, *University of Naples Federico II, Italy*
Roberta Antonia Ruggiero, *BeyondShape, Italy*
Angela Palomba, *University of Campania Luigi Vanvitelli, Italy*
Giuseppe Di Gironimo, *University of Naples Federico II, Italy*

14:25 - 17:15 CEST

IOT RAPID-PROTO LABS: AN EUROPEAN TRANSNATIONAL OPPORTUNITY

Room: Virtual Room #3

14:25 **Welcome and Keynote introduction**

14:30 **Keynote on the theme of AI in IoT**

Creating value with IoT and AI
Antti Merilehto
CGO, Chief Growth Officer
Houston Analytics, Finland

15:15 **Break**

15:30 **Panel**

Intro to panel
Amy Murphy/Elisabetta Farella, Fondazione Bruno Kessler;

Brief description IoT Rapid ProtoLabs project and Goals;

Overview Panel.

Education for IoT
Wilfried Admiraal, Leiden University

Design for IoT
Gerd Kortuem, Delft University of Technology

Cloud for IoT
Ohto Rainio, Haaga-Helia University of Applied Sciences

HW/Firmware for IoT
Davide Brunelli, University of Trento

Moderated questions

16:15 **Break**

16:30 **3 minute student project videos**

Questions

16:45 **Introductions (~3minutes each) and questions**

17:00 **Networking and discussion**

16:20 - 17:10 CEST

TUTORIAL - SESSION 2

Room: Virtual Room #1

Chair: Eduardo Palermo, *Sapienza University of Roma, Italy*

Edge AI for IoT applications with MATLAB

Stefano Olivieri - *Mathworks*

17:20 - 18:10 CEST

PLENARY SESSION

Room: Virtual Room #1

Chair: Emiliano Schena, *Univesità Campus Bio-Medico di Roma, Italy*

Self-Powered Wearable Sensors for Pervasive Health and Environmental Monitoring

Veena Misra, *North Carolina State University, United States*

Technical Sessions - Wednesday, June 9

09:00 - 10:20 CEST
SESSION 7.1
SPECIAL SESSION: Zero Defect Manufacturing - Part I
Room: Virtual Room #1
Chairs: Daniela Kirchberger, *PROFACTOR GmbH, Austria*
Christian Eitzinger, *PROFACTOR GmbH, Austria*
Raul Poler, CIGIP - *Universitat Politècnica de València, Spain*

09:00 **The ROBxTASK architecture for interoperability of robotic systems**
Georg Weichhart, *PROFACTOR GmbH, Austria*
Andreas Pichler, *PROFACTOR GmbH, Austria*
Felix Strohmeier, *Salzburg Research Forschungsgesellschaft mbH, Austria*
Mathias Schmoigl, *Salzburg Research Forschungsgesellschaft mbH, Austria*
Helmut Zörrer, *PROFACTOR GmbH, Austria*

09:20 **Industrial Data Services for Quality Control in Smart Manufacturing – the i4Q Framework**
Anastasios Karakostas, *Centre for Research and Technology Hellas, Greece*
Raul Poler, *Universitat Politècnica de València, Spain*
Francisco Fraile, *Universitat Politècnica de València, Spain*
Stefanos Vrochidis, *Centre for Research and Technology Hellas, Greece*

09:40 **Deep learning for zero-defect inkjet-printing of electronics**
Flaig Minnette, *PROFACTOR GmbH, Austria*
Zambal Sebastian, *PROFACTOR GmbH, Austria*

10:00 **Multi-tenant Data Management in Collaborative Zero Defect Manufacturing**
Francisco Fraile, *Universitat Politècnica de València, Spain*
Leticia Montalvillo, *Industrial Cybersecurity IKERLAN, Spain*
María Ángeles Rodríguez, *Universitat Politècnica de València, Spain*
Héctor Navarro, *Universitat Politècnica de València, Spain*
Ángel Ortiz, *Universitat Politècnica de València, Spain*

09:00 - 10:20 CEST

SESSION 7.2

SPECIAL SESSION: Wearable Sensors and Devices for Unobtrusive Physiological Monitoring - Part I

Room: Virtual Room #2

Chairs: Carlo Massaroni, *Università Campus Bio-Medico di Roma, Italy*
Wei Gao, *California Institute of Technology, USA*
Alessandro Zompanti, *Università Campus Bio-Medico di Roma, Italy*
Giorgio Pennazza, *Università Campus Bio-Medico di Roma, Italy*

09:00 Metrological Characterization of a new textile sensor for temperature measurements and a comparison with a Pt100 sensor

Giorgia Mazzini, *University of Florence, Italy*
Lorenzo Capineri, *University of Florence, Italy*
Andrea Zanobini, *University of Florence, Italy*
Riccardo Marchesi, *Knitronix srl, Italy*

09:20 Wearable system for elbow angles estimation based on a polymer encapsulated conductive textile

Joshua Di Tocco, *Università Campus Bio-Medico di Roma, Italy*
Arianna Carnevale, *Università Campus Bio-Medico di Roma, Italy*
Marco Bravi, *Università Campus Bio-Medico di Roma, Italy*
Umile Giuseppe Longo, *Università Campus Bio-Medico di Roma, Italy*
Silvia Sterzi, *Università Campus Bio-Medico di Roma, Italy*
Carlo Massaroni, *Università Campus Bio-Medico di Roma, Italy*
Emiliano Schena, *Università Campus Bio-Medico di Roma, Italy*

09:40 Wearable Sensor based on Fiber Bragg Grating with Flexible Polymer for Squat Exercise

Dongjoo Shin, *Sungkyunkwan University, Republic of Korea*
Taesung Kim, *Sungkyunkwan University, Republic of Korea*

10:00 An accurate and stable bed-based ballistocardiogram measurement and analysis system

Niccolò Mora, *University of Parma, Italy*
Federico Cocconcelli, *University of Parma, Italy*
Guido Matrella, *University of Parma, Italy*
Giovanni Chiorboli, *University of Parma, Italy*
Paolo Ciampolini, *University of Parma, Italy*

09:00 - 10:20 CEST

SESSION 7.3

SPECIAL SESSION: Additive Manufacturing for Industry 4.0

Room: Virtual Room #3

Chairs: Eduardo Palermo, *Sapienza University of Rome, Italy*
Ilaria Mileti, *Sapienza University of Rome, Italy*
Livio D'Alvia, *Sapienza University of Rome, Italy*

09:00 Microwave characterization of Polyamide 6 Graphene Nanoplatelet Composites

Erika Pittella, *Pegaso University, Italy*
Emanuele Piuzzi, *Sapienza - University of Rome, Italy*
Pietro Russo, *Institute for Polymers, Composites and Biomaterials IPCB-CNR, Italy*
Francesco Fabbrocino, *Pegaso University, Italy*

09:20 FEM deformation analysis of a transtibial prosthesis fed with gait analysis data: A preliminary step towards restoring proprioception in amputees

Francesco Castelli Gattinara Di Zubiena, *Sapienza University of Rome, Italy*
Federica Perugini, *Sapienza University of Rome, Italy*
Marco Germanotta, *IRCCS Fondazione Don Carlo Gnocchi, Italy*
Irene Aprile, *IRCCS Fondazione Don Carlo Gnocchi, Italy*
Gabriele Cortis, *Sapienza University of Rome, Italy*
Zaccaria Del Prete, *Sapienza University of Rome, Italy*
Eduardo Palermo, *Sapienza University of Rome, Italy*

09:40 Reproducibility and Embedding Effects on Static Performace of 3D Printed Strain Gauges

Ilaria Mileti, *University Niccolò Cusano, Italy*
Luca Cortese, *Sapienza University of Rome, Italy*
Zaccaria Del Prete, *Sapienza University of Rome, Italy*
Eduardo Palermo, *Sapienza University of Rome, Italy*

10:00 Uncertainty assessment techniques for selective laser melting process control

Gennaro Salvatore Ponticelli, *University Niccolò Cusano, Italy*
Simone Venettacci, *University Niccolò Cusano, Italy*

Flaviana Tagliaferri, *University Niccolò Cusano, Italy*
Oliviero Giannini, *University Niccolò Cusano, Italy*
Fabrizio Patanè, *University Niccolò Cusano, Italy*
Stefano Guarino, *University Niccolò Cusano, Italy*

10:30 - 11:50 CEST
SESSION 8.1
SPECIAL SESSION: Zero Defect Manufacturing - Part II
Room: Virtual Room #1
Chairs: Daniela Kirchberger, *PROFACTOR GmbH, Austria*
Christian Eitzinger, *PROFACTOR GmbH, Austria*
Raul Poler, CIGIP - *Universitat Politècnica de València, Spain*

10:30 Smart Digital Twin for ZDM-based job-shop scheduling
Julio César Serrano Ruiz, *Universitat Politècnica de València, Spain*
Josefa Mula Bru, *Universitat Politècnica de València, Spain*
Raúl Poler Escoto, *Universitat Politècnica de València, Spain*

10:50 Big Data Provision for Digital Twins in Industry 4.0 Logistics Processes
Paulo Figueiras, *CTS, UNINOVA, Portugal*
Luis Lourenço, *CTS, UNINOVA, Portugal*
Ruben Costa, *CTS, UNINOVA, Portugal*
Diogo Graça, *Volkswagen Autoeuropa, Portugal*
Gisela Garcia, *Volkswagen Autoeuropa, Portugal*
Ricardo Jardim-Gonçalves, *CTS, UNINOVA, Portugal*

11:10 Towards Zero Defect Manufacturing: probabilistic model for quality control effectiveness
Elisa Verna, *Politecnico di Torino, Italy*
Gianfranco Genta, *Politecnico di Torino, Italy*
Maurizio Galetto, *Politecnico di Torino, Italy*
Fiorenzo Franceschini, *Politecnico di Torino, Italy*

11:30 Failure prediction through a model-driven machine learning method
Amirreza Baghbanpourasl, *PROFACTOR GmbH, Austria*
Daniela Kirchberger, *PROFACTOR GmbH, Austria*
Christian Eitzinger, *PROFACTOR GmbH, Austria*

10:30 - 11:50 CEST

SESSION 8.2

SPECIAL SESSION: Wearable Sensors and Devices for Unobtrusive Physiological Monitoring - Part II

Room: Virtual Room #2

Chairs: Carlo Massaroni, *Università Campus Bio-Medico di Roma, Italy*
Wei Gao, *California Institute of Technology, USA*
Alessandro Zompanti, *Università Campus Bio-Medico di Roma, Italy*
Giorgio Pennazza, *Università Campus Bio-Medico di Roma, Italy*

10:30 Smart Mattress Based on Fiber Bragg Grating Sensors for Respiratory Monitoring: A Feasibility Test

Francesca De Tommasi, *Università Campus Bio-Medico di Roma, Italy*
Daniela Lo Presti, *Università Campus Bio-Medico di Roma, Italy*
Massimiliano Carassiti, *Università Campus Bio-Medico di Roma, Italy*
Emiliano Schena, *Università Campus Bio-Medico di Roma, Italy*
Carlo Massaroni, *Università Campus Bio-Medico di Roma, Italy*

10:50 Single beat ECG-based Identification System: development and robustness test in different working conditions

Riccardo Sorvillo, *Università Campus Bio-Medico di Roma, Italy*
Luca Bacco, *Università Campus Bio-Medico di Roma, Italy*
Mario Merone, *Università Campus Bio-Medico di Roma, Italy*
Alessandro Zompanti, *Università Campus Bio-Medico di Roma, Italy*
Marco Santonico, *Università Campus Bio-Medico di Roma, Italy*
Giorgio Pennazza, *Università Campus Bio-Medico di Roma, Italy*
Giulio Iannello, *Università Campus Bio-Medico di Roma, Italy*

11:10 Respiratory Rate Estimation During Walking/Running Activities Using Principal Components Estimated from Signals Recorded by a Smart Garment Embedding Piezoresistive Sensors

Luigi Raiano, *Università Campus Bio-Medico di Roma, Italy*
Joshua Di Tocco, *Università Campus Bio-Medico di Roma, Italy*
Carlo Massaroni, *Università Campus Bio-Medico di Roma, Italy*
Giovanni Di Pino, *Università Campus Bio-Medico di Roma, Italy*

Emiliano Schena, *Università Campus Bio-Medico di Roma, Italy*
Domenico Formica, *Università Campus Bio-Medico di Roma, Italy*

11:30 An undershirt for monitoring of multi-lead ECG and respiration wave signals
Luca De Vito, *University of Sannio, Italy*
Enrico Picariello, *University of Sannio, Italy*
Francesco Picariello, *University of Sannio, Italy*
Ioan Tudosa, *University of Sannio, Italy*
Luca Loprevite, *Modaimpresa S.r.l., Italy*
Davide Avicolli, *Modaimpresa S.r.l., Italy*
Gennaro Laudato, *University of Molise, Italy*
Rocco Oliveto, *University of Molise, Italy*

10:30 - 11:50 CEST
SESSION 8.3
GENERAL SESSION - PART II
Room: Virtual Room #3
Chair: Joshua Di Tocco, *Università Campus Bio-Medico di Roma, Italy*

10:30 Missing data imputation in meteorological datasets with the GAIN method
Marina Popolizio, *Politecnico di Bari, Italy*
Alberto Amato, *Politecnico di Bari, Italy*
Tiziano Politi, *Politecnico di Bari, Italy*
Roberto Calienno, *Università Giustino Fortunato, Italy*
Vincenzo Di Lecce, *Politecnico di Bari, Italy*

10:50 Metrological Characterization of Measurement Systems through Monte Carlo Simulations, Design of Experiments and Robotic Manipulation
Davide Maria Fabris, *Politecnico di Milano, Italy*
Alice Meldoli, *Politecnico di Milano, Italy*
Remo Sala, *Politecnico di Milano, Italy*
Marco Tarabini, *Politecnico di Milano, Italy*

11:10 Microfluidic arena for high-throughput C. elegans calcium imaging experiments with multiple strain confinement
Enrico Lanza, *Istituto Italiano di Tecnologia, Italy*
Davide Caprini, *Istituto Italiano di Tecnologia, Italy*
Valeria Lucente, *Istituto Italiano di Tecnologia, Italy*
Viola Folli, *Istituto Italiano di Tecnologia, Italy*

11:30 A WAMS emulation framework for the characterization of measurement algorithms on electrical transmission networks

Annalisa Liccardo, *University of Naples Federico II, Italy*
Salvatore Tessitore, *Terna Rete Italia, Italy*
Cosimo Pisani, *Terna Rete Italia, Italy*
Francesco Bonavolontà, *University of Naples Federico II, Italy*
Salvatore Cacciapuoti, *University of Naples Federico II, Italy*
Giorgio Maria Giannuzzi, *Terna Rete Italia, Italy*

14:00 - 15:40 CEST

SESSION 9.1

SPECIAL SESSION: Sensors, measurement systems and methods for in-line control, safety and security

Room: Virtual Room #1

Chairs: Alessandro Schiavi, *INRiM - National Institute of Metrological Research, Italy*
Ada Fort, *University of Siena, Italy*

14:00 Towards large-scale calibrations: a statistical analysis on 100 digital 3-axis MEMS accelerometers

Andrea Prato, *INRiM – National Institute of Metrological Research, Italy*
Fabrizio Mazzoleni, *INRiM – National Institute of Metrological Research, Italy*
Francesca R. Pennecchi, *INRiM – National Institute of Metrological Research, Italy*
Gianfranco Genta, *Politecnico di Torino, Italy*
Maurizio Galetto, *Politecnico di Torino, Italy*
Alessandro Schiavi, *INRiM – National Institute of Metrological Research, Italy*

14:20 NO2 photoacoustic sensing system based on resonant cell and UV-LED sensor

Ada Fort, *University of Siena, Italy*
Enza Panzardi, *University of Siena, Italy*
Valerio Vignoli, *University of Siena, Italy*
Elia Landi, *University of Siena, Italy*
Marco Mugnaini, *University of Siena, Italy*
Klaus Stefan Drese, *Coburg University of Applied Sciences and Arts, Germany*

14:40 Quasi-Real Time Remote Video Surveillance Unit for LoRaWAN-based Image Transmission

Ada Fort, *University of Siena, Italy*
Giacomo Peruzzi, *University of Siena, Italy*
Alessandro Pozzebon, *University of Siena, Italy*

15:00 A Dynamic Uncertainty Protocol for Digital Sensor Networks

Michael Gaitan, *NIST, USA*
Richard A. Allen, *NIST, USA*
Jon Geist, *NIST, USA*
Akobuije Chijioke, *NIST, USA*

15:20 Condition Monitoring with LoRaWAN: Preliminary Tests on Gas Turbine Exciters

Gabriele Di Renzone, *University of Siena, Italy*
Ada Fort, *University of Siena, Italy*
Marco Mugnaini, *University of Siena, Italy*
Alessandro Pozzebon, *University of Siena, Italy*
Valerio Vignoli, *University of Siena, Italy*
Alessandro Elmi, *Alta Industries S.R.L., Italy*

14:00 - 15:40 CEST

SESSION 9.2

SPECIAL SESSION: AI-Enhanced Sensing for Industrial and Medical IoT Applications - Part II

Room: Virtual Room #2

Chairs: Luca Vollero, *University Campus Bio-Medico of Rome, Italy*
Samuel Oluwarotimi Williams, *Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, China*

14:00 A Comparative Analysis on the Impact of Linear and Non-Linear Filtering Techniques on EMG Signal Quality of Transhumeral Amputees

Yazan Jarrah, *SIAT-UCAS, China*
Mojisola Asogbon, *Shenzhen Institute of Advanced Technology, China*
Samuel W. Oluwarotimi, *Shenzhen Institutes of Advanced Technology, China*

Mingxing Zhu, Shenzhen *Institutes of Advanced Technology, Chinese Academy of Sciences, China*
Xin Wang, *Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, China*
Obe O Olumide, *Federal University of Technology, Nigeria*
Shixiong Chen, *Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, China*
Guanglin Li, *SIAT, China*

14:20 A Deep Learning based Model for Decoding Motion Intent of Traumatic Brain Injured Patients' using HDsEMG Recordings

Mojisola Asogbon, *Shenzhen Institute of Advanced Technology, China*
Samuel W. Oluwarotimi, *Shenzhen Institutes of Advanced Technology, China*
Ejay Nsugbe, *Independent Researcher, United Kingdom*
Yazan Jarrah, *SIAT-UCAS, China*
Obe O Olumide, *Federal University of Technology, Nigeria*
Yanjuan Geng, *Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences, China*
Guanglin Li, *SIAT, China*

14:40 A Novel Synchronous Hybrid Steady-State Brain-Computer Interface Based on Visual and Auditory Integration

Jun Xie, *Xi'an Jiaotong University, China*
Zhiyuan Ren, *Xi'an Jiaotong University, China*
Yi Liu, *Beijing Institute of Astronautical Systems Engineering, China*
Peng Fang, *Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, China*
Guanglin Li, *SIAT, China*
Mengwei Zhang, *Xi'an Jiaotong University, China*

15:00 NMF Based System for Speaker Identification

Giovanni Costantini, *University of Rome Tor Vergata, Italy*
Valerio Cesarini, *University of Rome Tor Vergata, Italy*
Fabio Paolizzo, *University of Rome Tor Vergata, Italy*

15:20 A New Multilabel System for Automatic Music Emotion Recognition

Fabio Paolizzo, *University of Rome Tor Vergata, Italy*
Natalia Pichierri, *University of Rome Tor Vergata, Italy*
Daniele Giardino, *University of Rome Tor Vergata, Italy*

Marco Matta, *University of Rome Tor Vergata, Italy*
Daniele Casali, *University of Rome Tor Vergata, Italy*
Giovanni Costantini, *University of Rome Tor Vergata, Italy*

14:00 - 15:40 CEST
SESSION 9.3
SPECIAL SESSION: Measurement Systems in the Industrial IoT era
Room: Virtual Room #3
Chairs: Ivanovitch Silva, *Federal University of Rio Grande do Norte, Brazil*
Dennis Brandão, *Universidade de São Paulo, Brazil*
Paolo Ferrari, *University of Brescia, Italy*

14:00 Impact of Usage Profiles on Remaining Useful Life and Post-Prognostic Maintenance Decisions
Roberto Bodo, *Università degli Studi di Padova, Italy*
Matteo Bertocco, *Università degli Studi di Padova, Italy*
Alberto Bianchi, *Carel Industries SPA, Italy*

14:20 Towards fixtureless robotic in-line measurement assisted assembly, a case study
Victor Azamfirei, *Malardalen University, Sweden*
Anna Granlund, *Malardalen University, Sweden*
Yvonne Lagrosen, *Malardalen University, Sweden*
William J. Palm, *Robotdalen, Sweden*

14:40 An Unsupervised TinyML Approach Applied for Pavement Anomalies Detection Under the Internet of Intelligent Vehicles
Pedro Andrade, *Federal University of Rio Grande do Norte, Brazil*
Ivanovitch Silva, *Federal University of Rio Grande do Norte, Brazil*
Gabriel Signoretti, *Federal University of Rio Grande do Norte, Brazil*
Marianne Silva, *Federal University of Rio Grande do Norte, Brazil*
Joao Dias, *Federal University of Rio Grande do Norte, Brazil*
Lucas Marques, *Federal University of Rio Grande do Norte, Brazil*
Daniel G. Costa, *State University of Feira de Santana, Brazil*

15:00 MSensorMob: A Multi-Sensors Hardware Framework to Support the Development of Adaptable Monitoring Units in Mobile Applications

Franklin Oliveira, *State University of Feira de Santana, Brazil*
Daniel G. Costa, *State University of Feira de Santana, Brazil*
Ivanovitch Silva, *Federal University of Rio Grande do Norte, Brazil*
Pedro Andrade, *Federal University of Rio Grande do Norte, Brazil*
Anfranserai Dias, *State University of Feira de Santana, Brazil*

15:20 RFID based Predictive Maintenance System for Chemical Industry

Simone Nappi, *University of Rome Tor Vergata & Radio6ense srl, Italy*
Sara Amendola, *University of Rome Tor Vergata & Radio6ense srl, Italy*
Marco Ramacciotti, *ISE srl, Italy*
Edoardo Zambonini, *ISE srl, Italy*
Nicola D'Uva, *Radio6ense srl, Italy*
Francesca Camera, *University of Rome Tor Vergata, Italy*
Carolina Miozzi, *University of Rome Tor Vergata, Italy*
Cecilia Occhiuzzi, *University of Roma Tor Vergata & DICII, Italy*
Gaetano Marrocco, *University of Rome Tor Vergata, Italy*

15:50 - 17:10 CEST
SESSION 10.1
SPECIAL SESSION: Wireless Solutions for IoT-based Measurements over Wide Areas
Room: Virtual Room #1
Chairs: Emiliano Sisinni, *University of Brescia, Italy*
Diego Silva, *Federal University of Rio Grande do Norte, Brazil*
Federico Tramarin, *University of Modena and Reggio Emilia, Italy*

15:50 A real-time MCU-based wireless system for remote monitoring of PV devices

Antonino Laudani, *Roma Tre University, Italy*
Valentina Lucaferri, *Roma Tre University, Italy*
Martina Radicioni, *Roma Tre University, Italy*
Francesco Riganti Fulginei, *Roma Tre University, Italy*

16:10 Turning old into new: adding LoRaWAN connectivity to PLC in brownfield installations

Paolo Ferrari, *University of Brescia, Italy*
Emiliano Sisinni, *University of Brescia, Italy*
Paolo Bellagente, *University of Brescia, Italy*
Alessandro Depari, *University of Brescia, Italy*
Dhiego Fernandes Carvalho, *University of Brescia, Italy*
Alessandra Flammini, *University of Brescia, Italy*
Marco Pasetti, *University of Brescia, Italy*
Stefano Rinaldi, *University of Brescia, Italy*

16:30 Adaptive LoRaWAN Transmission exploiting Reinforcement Learning: the Industrial Case

Tommaso Fedullo, *University of Padova, Italy*
Alberto Morato, *University of Padova, Italy*
Federico Tramarin, *University of Modena and Reggio Emilia, Italy*
Paolo Bellagente, *University of Brescia, Italy*
Paolo Ferrari, *University of Brescia, Italy*
Emiliano Sisinni, *University of Brescia, Italy*

16:50 IoT framework with flexible management of multi-protocol nodes for redundancy applications

Diego Silva, *Universidade Federal do Rio Grande do Norte, Brazil*
Vinicius S. S. Lima, *Federal University of Rio Grande do Norte, Brazil*
Hudson B. M. Alves, *Federal University of Rio Grande do Norte, Brazil*
Rafael N Cunha, *Universidade Federal do Rio Grande do Norte, Brazil*
Emiliano Sisinni, *University of Brescia, Italy*
Paolo Ferrari, *University of Brescia, Italy*

15:50 - 17:10 CEST

SESSION 10.2

SPECIAL SESSION: Measurements and Virtual Measurements for Industry 4.0: Approaches and Solutions for Smart Manufacturing

Room: Virtual Room #2

Chairs: Giulio D'Emilia, *University of L'Aquila, Italy*
Antonella Gaspari, *Polytechnic of Bari, Italy*
Emanuela Natale, *University of L'Aquila, Italy*

15:50 Edge-enabled cloud computing management platform for smart manufacturing

Jeffrey Ying, *Caloudi Corporation, Taiwan*
Jackie Hsieh, *Caloudi Corporation, Taiwan*
Dennis Hou, *Caloudi Corporation, Taiwan*
Janpu Hou, *Caloudi Corporation, Taiwan*
Tuo Liu, *Yuanjie Semiconductor Technology, China*
Xiaobin Zhang, *Yuanjie Semiconductor Technology, China*
Yuxi Wang, *Yuanjie Semiconductor Technology, China*
Yen-Ting Pan, *Yuanjie Semiconductor Technology, China*

16:10 Managing the sampling rate variability of digital MEMS accelerometers in dynamic calibration

Giulio D'Emilia, *University of L'Aquila, Italy*
Antonella Gaspari, *Politecnico di Bari, Italy*
Emanuela Natale, *University of L'Aquila, Italy*
Andrea Prato, *INRiM - National Institute of Metrological Research, Italy*
Fabrizio Mazzoleni, *INRiM - National Institute of Metrological Research, Italy*
Alessandro Schiavi, *INRiM - National Institute of Metrological Research, Italy*

16:30 Dimensional measurements in production line: a comparison between a custom-made telecentric optical profilometer and on-the-market measurement systems

Alessia Baleani, *Università Politecnica delle Marche, Italy*
Paolo Castellini, *Università Politecnica delle Marche, Italy*
Paolo Chiariotti, *Politecnico di Milano, Italy*
Nicola Paone, *Università Politecnica delle Marche, Italy*
Daniele Roccetti, *Quality Manager Zannini, Italy*
Lorenzo Zampetti, *Project Engineer Z4tec, Italy*
Marco Zannini, *General Manager Zannini, Italy*
Saverio Zitti, *Business Developer Z4tec, Italy*

16:50 Enhancing Object Detection Performance Through Sensor Pose Definition with Bayesian Optimization

Loris Roveda, *Istituto Dalle Molle di studi sull'Intelligenza Artificiale, Switzerland*
Marco Maroni, *Politecnico di Milano, Italy*

Lorenzo Mazzuchelli, *Politecnico di Milano, Italy*
Loris Praolini, *Politecnico di Milano, Italy*
Giuseppe Bucca, *Politecnico di Milano, Italy*
Dario Piga, *Istituto Dalle Molle di studi sull'Intelligenza Artificiale, Switzerland*

15:50 - 17:10 CEST

SESSION 10.3

SPECIAL SESSION: Cybersecurity Standards and Technologies for IoT and Industry 4.0 (SecurityStandards)

Room: Virtual Room #3

Chairs: Alan Oliveira de Sá, *Admiral Wandenkolk Instruction Center, Brazil*
Lucila Maria de Souza Bento, *Inmetro, Brazil*

15:50 Securing the metrological chain in IoT environments: an architectural framework

Helder Aranha, *ESPAP, I.P., Portugal*
Massimiliano Masi, *Tiani "Spirit" GmbH, Austria*
Tanja Pavleska, *Jozef Stefan Institute, Slovenia*
Giovanni Paolo Sellitto, *Independent Scholar*

16:10 Soft Computing Optimization of Stealth Data Loss Attack to Industrial Control Systems

Philippe de A. A. Ciampi, *Brazilian Navy, Brazil*
Micky Steve M. Lins, *Brazilian Navy, Brazil*
Paolo Ferrari, *University of Brescia, Italy*
Alan Oliveira de Sá, *Brazilian Navy, Brazil*

16:30 Testing and selecting lightweight pseudo-random number generators for IoT devices

Augusto Parisot, *Fluminense Federal University, Brazil*
Lucila M. S. Bento, *Nautilus Laboratory Armor Shield Innovation Company, Brazil*
Raphael C. S. Machado, *Nat. Inst. Metrology, Quality and Technology, Fluminense Federal University, Brazil*

16:50 Towards a Practical Information Security Maturity Evaluation Method focused on People, Process and Technology

Davidson R. Boccardo, *Clavis Information Security, Brazil*
Lucila M. S. Bento, *Armor Shield Innovation Co, Brazil*
Fernando H. Costa, *Clavis Information Security, Brazil*

17:20 - 17:40 CEST
CLOSING AND AWARD CEREMONY
Room: Virtual Room #1