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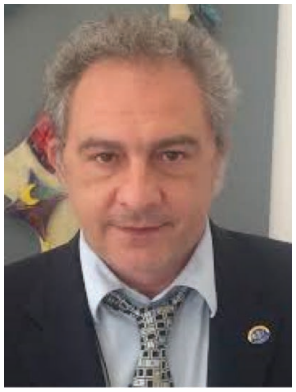
From the Editors of the Special Issue on Selected Methods and Instrumentation of Metrology for AeroSpace

Pasquale Daponte, Stefano Debei

Pasquale Daponte



Syefano Debei

Metrology is the theoretical and experimental interdisciplinary science of the measurement for each research and application field. In the aerospace field, metrology plays a fundamental role both for certification and for calibration of instrumentation. In addition, it drives the ideation and design of innovative instrumentation and experimental setups to reproduce on the ground aerospace environments.

In this issue, we try to demonstrate this, highlighting the importance of measurement and instrumentation for all activities involved in aerospace. Aerospace projects need innovative and unique test and measurement solutions throughout the entire product life cycle, from modelling and simulation on a research and development bench to flight testing and operational applications. Innovation in aerospace technologies takes place at an increasingly fast pace, as does the development of test and measurement methodologies and technologies, and this is important for miniaturization and increasingly integrated solutions to minimize the necessary resources. Companies and researchers should focus on the development of the next generations of aerospace equipment and, in the meantime, must ensure their effectiveness before they are used in an operational context.

This issue is based on extended papers previously discussed during the 4th edition of the IEEE International Workshop on Metrology for Aerospace (MetroAeroSpace, www.metroaerospace.org) held in Padua, Italy, in June 2017. To date, apart from industry conferences on specific issues related to the field of metrological interest, there has been no dedicated conference series putting together experts in aerospace metrology. MetroAeroSpace was proposed as an international meeting place in the world of research in the field of metrology for aerospace involving national and international institutions and academia to discuss the state of the art concerning issues that require a joint approach by experts from measurement instrumentation and industrial testing, typically expert engineers, and researchers in innovation metrology, usually academics.

To cover the most important topics of metrology for aerospace, in addition to general sessions, experts in the field organized several special sessions, such as the following:

- Instruments and Technology for Exploration
- Measurement for Improving Quality, Reliability, and Safety in Aerospace Applications
- Complex Systems Operational Availability: Measurements, Methodologies, and Requirements
- Quality Measurement Techniques for Critical Software Systems
- Measurement and Instrumentation for Aerospace Application
- Meteorological Sensors and Sensor Systems for Flight Support
- Nondestructive Testing and Evaluation for Aerospace
- Terrestrial and In-Flight Verification of the GNC Systems for Satellites and Aerospace Vehicles
- Metrology for Radar Systems
- Relativistic Metrology
- Smart Materials and Structures for Actuators and Sensors in Aerospace and Space
- Interferometric and Optical Systems for Accelerometers and Attitude Sensors
- Metrology and Instrumentation for Unmanned Aerial Vehicles

The articles selected are contributions across this range of topics, and they reflect some crucial topics in metrology for aerospace. The first article, "Proposed Landing on Europa: Instruments, Radiation Shielding, Planetary Protection, and Mission" by K. R. Fowler and S. A. Dyer, explores the design of a space mission from the measurement and instrument point of view. It analyzes all topics concerning measuring instruments for a lander vehicle for studying Europa. The article is an interesting view on the difficulties and challenges for setting up instruments for a space mission.

The second article, "A Cryogenic 0.35 μm CMOS Technology BSIM3.3 Model for Space Instrumentation: Application to a Bandgap Design," cowritten by L. Varizat, G. Sou, M. Mansour, and D. Alison and awarded as the best MetroAeroSpace 2017 paper, deals with state-of-the-art electronics providing high performance under extreme conditions for space instrumentation, starting from small products to obtain a great mission.

Aerospace companies rely on modern software analysis, test, and verification tools to ensure the safety, certification, and deployment of sensors for safety- and mission-critical airborne systems and platforms. This is particularly important for sensors such as the inertial measurement unit (IMU). This topic is discussed in the third article, "An Overview of a New Sensor Calibration Platform," by P. Clausen, J. Skaloud, R. Molinari, J. Lee, J. Balamuta, W. Yang, and S. Guerrier.

In the aerospace industry, many structural components such as wing panels and radomes are made with fiberglass and advanced composites that need accurate control. Composites are often stronger than conventional materials and weigh less. A method for monitoring the health of the structure in composite panels by employing neural networks is carried out and discussed in the fourth article, "Artificial Neural Networks for Impact Force Reconstruction on Composite Plates," by G. Sarego, M. Zaccariotto and U. Galvanetto.

The fifth and sixth articles deal with unmanned aerial vehicles (UAVs). The fifth article, "A Remote-Controlled Platform for UAS Testing," cowritten by B. Brzozowski, P. Daponte, L. De Vito, F. Lamonaca, F. Picariello, M. Pompetti, I. Tudosa, and K. Wojtowicz, deals with a test bench called DronesBench, i.e., a testing platform for UAV metrological characterization and fault identification. The sixth article, titled "An UAV System for Photovoltaic Plants Inspection," by P. Addabbo, A. Angrisano, M. Bernardi, G. Gagliarde, A. Mennella, M. Nisi, and S. Ullo, proposes UAVs as substitutes for human workers for inspecting photovoltaic plants to reduce maintenance costs and intervention times.

Lastly, we wish to underline that aerospace organizations worldwide are simultaneously maintaining current equipment and driving toward more complex, sophisticated systems—growing the need for more capable test and measurement equipment. All this highlights how metrology for aerospace is a broad and rewarding area of research, and the articles in this special issue reflect this.

We commend them to you! ◈