

## Special Session 1

# Six-Port and Multi-Port Technology for RF Sensing Applications

Submit Your Paper by Oct. 5, 2015



*Organized by*



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## Introduction

The six-port concept has been introduced in the early 1970s as a simple and accurate technique for the measurement of microwave signals. After 45 years of development, the research community has contributed to develop the universal nature of the Six-Port in a wide range of RF, microwave and millimeter-wave applications. In particular, the six-port technology has been successfully addressed in metrology, telecommunications, radar and biomedical applications to cite only a few of them. The focus session is dedicated to present the last advances in the development of six-port instrumentations and techniques.

The special session proposed is well suited for the IEEE I2MTC conference and in particular for the theme of the conference “Measuring the Pulse of Industries, Nature and Humans”. Indeed, the growing interest of six-port based techniques and systems is driven by drastic requirements in terms of cost, consumption, compactness to address emergent fields and bring closer industry and academia. Six-port systems for nondestructive applications, sensing systems for nature and healthcare applications have been recently reported. This special session is also a great opportunity to reaffirm the position of the IEEE IM Society that has accompanied the development of the six-port technology with several works published in the IEEE Transactions on Instrumentation and Measurement.



# Impedance Spectroscopy for Measurement and Sensor Solutions

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**2<sup>nd</sup> IMTC** 2016 IEEE  
International Instrumentation  
and Measurement Technology  
Conference  
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*Measuring the Pulse of Nature, Industries and Humans*

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## Introduction

Impedance Spectroscopy is an interesting measurement method in many fields of science and technology including medicine, chemistry and material science. The possibility to use information from complex impedance over a wide frequency range leads to interesting opportunities for separating effects, accurate measurements and measurements of nonaccessible quantities. Especially in the field of sensors a multifunctional measurement can be realized. But for this measurement method, several aspects should be specifically addressed such as, impedance measurement procedures, investigations of physical and chemical phenomena taking place, development of suitable impedance models and extraction of target information by optimization techniques. In some applications the low cost realization in embedded systems leads to highly interesting scientific challenges.

## Topics of interest

This special session invites articles that deal with fundamentals, techniques or applications of Impedance Spectroscopy related to:

- Characterization of Energy Storage units, Batteries and Fuel Cells
- Biomedical and Biological Applications
- Material Testing, Corrosion and Coatings
- Inductive, Capacitive and Resistive Sensors
- Measurements of Dielectric Materials and Solid State Systems
- Local Electrochemical Impedance Spectroscopy
- Signal Processing and Modelling
- Instrumentation & Data Acquisition

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## Advances in Industrial Tomography: Sensor design, Instrumentation, Image Reconstruction algorithms and Measurement

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## Introduction

Industrial tomography techniques have been developed for measurement of internal behaviour of complicated processes, which are difficult to be measured otherwise. There are several different sensing modalities from high frequency to low frequency:

- Gamma ray tomography,
- X-ray tomography,
- Near infrared tomography,
- THz tomography,
- Microwave tomography,
- Electrical resistance tomography (ERT),
- Electrical capacitance tomography (ECT),
- Electro-magnetic tomography (EMT),
- Ultrasonic tomography,
- Acoustic tomography.

Although those techniques have been developed for many years, they are still being advanced, from sensor design and instrumentation to image reconstruction algorithms and measurement. Recent advances in industrial tomography have been demonstrated by real industrial applications, such as the measurement of gas/oil/water three-component flows and fluidised beds. This special session is seeking for papers on recent research and development on industrial tomography. Suitable topics for this special session include but are not limited to:

- New sensor structure, including 3D sensors,
- New measurement circuits and new computer interface,
- Advance in image reconstruction algorithms,
- Multi-modality tomography,
- Addressing challenges in industrial applications,
- Other-related topics.





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## Introduction

Engineering system health monitoring has attracted increasing attention during the last decade and significant research efforts have been taken by both academia and industry. Dynamical changes of engineering systems have to be captured in time for safe and reliable operations. These tasks are typically realized by using measurement technologies in combination with data processing algorithms. Recent advances in the theory and methodology for measurement and data processing have provided viable tools to dealing with issues encountered in engineering system health monitoring. This invited session aims to provide a platform for academic and industrial communities to report recent research and development on engineering system health monitoring with theoretical and/or applied nature.

## Topics of interest

- New measurement methodology for system health monitoring
- Wireless sensor networks for distributed measurement
- Advanced time scale/frequency analysis
- Intelligent health monitoring and prognosis
- Non-linear time series analysis
- Other-related topics.





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**Introduction**

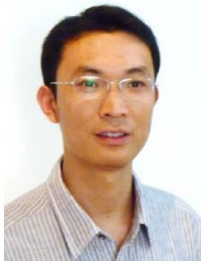
The increasing use of navigation technologies for industries as diverse as aerospace, marine and transport civil construction , deformation measurement has resulted in the development of navigation systems such as strapdown inertial navigation systems, integrated navigation systems, GPS receivers, GNSS software receivers ,wireless positioning and inertial sensors such as gyroscopes, accelerometers etc..

The special session aims to promote the advancement of measurement and instrumentation supporting navigation technologies and related applications. Selected papers on recent research and development on advanced inertial sensor technologies, wireless sensor technologies, GNSS signal processing, inertial alignment, calibration, filtering simulation and experimental studies for related application, etc. will be organized. The special session will promote papers from emerging R&D on the expansion of measurement and instrumentation for navigation technologies and related applications for aerospace, marine transport etc.





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## Introduction

The increasing use of different types of materials in critical structural components, such as the tracks, aerospace materials, nuclear power equipment, wind turbine blade, has led to the development of non-destructive testing and evaluation (NDT& E) technologies for characterizing and identifying potential defects. Particularly, the presence of defects in critical components may result in degraded structural integrity and increase the likelihood of catastrophic failure.

As NDT&E mainly depends on retrieving information about structural components through sensing technologies and information processing, it is often driven by advances in instrumentation and measurement. The special session aims to solicit papers on advancement of measurement and instrumentation that support the NDT&E for the purpose of structural quality assurance.



## Special Session 7

### Instrumentation and Measurement For Improving Quality, Reliability And Safety: New Perspectives for Research and Industry

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## Introduction

Nowadays in many contexts it is mandatory to fulfill performance of Testing and Diagnostics, Reliability, Maintainability, Safety and Risk assessment. Such tasks play a fundamental role in different fields of application (energy, transportation, information and communication technology, logistics, etc.) and are considered as fundamental in high-tech industry and plants. This Special Session represents an interesting opportunity for engineers and researchers who work in this area to meet and discuss about live issues. In particular, useful and beneficial discussion can be promoted with the aim to provide an increasing of knowledge and an easier diffusion of the most recent developments.

## Topics of interest

- Instrumentation and measurement methods for Testing and Diagnostics (Destructive and Non-destructive Testing, Vibration monitoring, Built-in Test Equipment and Automatic Test Equipment, etc.)
- Condition monitoring and maintenance of industrial process, plants and complex systems
- Measurements and techniques for Fault detection and diagnosis
- Design and implementation of laboratory tests (Reliability test, Environmental test, Burn-in test, quality tests, etc.) and Qualification tests for components, assemblies and process
- Measurements, methods and instrumentation for evaluation of Reliability, Availability, Maintainability and Safety (RAMS), Risk assessment and management
- Impact of RAMS requirements in the emerging technologies for Life and Society, environment and new energy sources
- Effects of measurement uncertainty on the estimation of the RAMS parameters
- Standards definition, certification and accreditation.





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## Introduction

Due to enormous advances in sensing, computing and communication technologies, we witness important ubiquitous healthcare systems developments such as wearable devices for physiological parameter monitoring, cloud-connected body area sensors, and smart objects for smart health. Nowadays challenges may be expressed by the necessity to translate wearable and implantable concepts and prototypes in daily used systems for population in the ageing era.

The essence of this special session lies in its interdisciplinary nature, joining contributors that work in the fields of smart sensors, wireless, intra and mobile communications, smart materials as well as medical measurements.

## Topics of interest

- Wearable communication standards for wearable sensor networks
- Intra-body communication issues (propagation & transmission)
- Wireless Body Sensor Networks (WBSN)
- Implantable Wireless Body Sensor Network (IWBSN)
- Sensor data fusion
- Wearable sensing for Smart Health (S-health)
- Wireless wearable sensing systems for physical therapy
- Wireless M2M for m-Health and s-Health
- Power Harvesting and energy management for IWBSN and WBSN





## Special Session 9

# Nanotechnology Applications in Instrumentation and Measurement

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## Introduction

Nanotechnology has been developing plenty of aspects both theoretical and application with high impact in human being' daily life. At nanoscale many assumptions used for normal and micro-scale lose their meaning because quantum effects prevail. These effects change the approach that can be adopted using instrumentation and performing measurements. Hence, noise and interferences must be taken into account in a special way. This precautionary approach allows to perform accurate measurements for different fields, namely, biomedical, environmental, telecommunications and industrial. The special session intends to serve as a dedicated forum aimed at illustrating advances in the aforementioned fields with a great outlook on instrumentation and measurement, detailing specific aspects as, for instance, metrology, accuracy, uncertainty, new techniques, testing, signal processing, hardware features, characterization, experimental setup, etc.. The special session will be inaugurated by an invited presentation that will be delivered by Prof. Cheng-Hsin Chuang who is with the Department of Mechanical Engineering and Institute of Nanotechnology at Southern Taiwan University of Science and Technology. Prospective authors are invited to submit their latest research to this session.

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## Introduction

Modern miniaturization technologies and innovative sensing capacities have been created a new industry of smart medical devices in medical diagnostics and life-management tools. The goal is to gather multi-disciplinary groups of experts, including researchers, engineers, and medical professionals to discuss and share experiences of developing smart medical devices from lab to clinical practices and integrating to current healthcare system.

## Topics of interest

- Innovative Sensing Technologies for Biomedical Applications
- Modern Sampling and Actuating Technologies for Smart Devices
- Biomedical Instruments for Measurement and Analysis
- Wireless Device and Interface
- Wearable Medical Devices
- Others



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## Introduction

The ubiquity of networks and networking have profound effects on most human activities. In many applications, taking a net-centric viewpoint implies dramatic revisions of well-established paradigms.

This is all the more true in the field of measurement, where networking opens broad new spaces for applications. Proven approaches, ensuring that measurement provides trusted and accurate information, need to be re-assessed. Aspects like communications and protocols, mostly seen as irrelevant to measurement until recently, are now integral parts of distributed measurement systems, contributing to their performances.

The challenge for researchers and developers in the I&M community is to successfully integrate networking aspects in measurement, to realize and characterize successful innovative systems. In so doing, they may hit upon new techniques and follow innovative ideas, in a word, contribute to the advancement of measurement science. This special session is looking for recent and original research and development contributions, where the interactions of networking and measurement in systems architecture and performances are highlighted.

## Topics of interest

- sensor networks: new applications and characterization strategies
- network aspects in distributed measurement systems – supporting applications
- advanced network equipment: monitoring and troubleshooting in 4G and 5G networks
- security in distributed measurement systems
- educational challenges of networked measurement systems



# Wearable and Implantable Wireless Sensors for Healthcare

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## Introduction

Due to enormous advances in sensing, computing and communication technologies, we witness important ubiquitous healthcare systems developments such as wearable devices for physiological parameter monitoring, cloud-connected body area sensors, and smart objects for smart health. Nowadays challenges may be expressed by the necessity to translate wearable and implantable concepts and prototypes in daily used systems for population in the ageing era.

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- Sensor data fusion
- Wearable sensing for Smart Health (S-health)
- Wireless wearable sensing systems for physical therapy
- Wireless M2M for m-Health and s-Health
- Power Harvesting and energy management for IWBSN and WBSN



# Measurements for emerging power systems

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## Introduction

The increased use of renewables and the aim of attaining higher efficiency for all stages of the energy transfer have triggered massive transformation of power systems. Smart grids, intelligent communities, microgrids, transport electrification, ambitious sustainability and efficiency targets – they are all requiring new measurements, sensing and communication technologies and standards. The goal of the proposed special session is to gather experts and practitioners from all industries grouped under the umbrella of smart grid to discuss the need for advanced sensing and monitoring technologies, to learn from existing large scale implementations of measurement systems and to actively shape the measurement layer of the emerging power systems.

## Topics of interest

- energy metering and smart metering technologies;
- metering standards in electric power industry
- synchronized measurements and associated models;
- performance of communication infrastructures in WAMCS
- measurement uncertainty evaluation in complex grid applications
- measurements for microgrids control
- measurements for renewable-based generation forecasting
- measurements and techniques for load estimation
- measurements for grid integration of energy storage units
- health monitoring systems for power systems assets
- applications of state estimation in distribution grids

