

8:45 to 17:50 Room: Euphemia

## WFMO1 (EuMC/EuWiT)

### Advances in RFID Tags and Systems

#### Organisers:

Jochen Eßel, University of Erlangen-Nürnberg, Germany  
 Robert Weigel, University of Erlangen-Nürnberg, Germany  
 Harald Witschnig, NXP, Austria

#### Abstract

Contactless Technologies (from wireless communications, contactless smartcards to RFID) show already a strong influence on our daily life and will have an even stronger impact in future. They influence industrial processes, automotive and medical applications, life sciences and even life style. RFID has gained significant interest during the last years, as the potential of the technology is enormous, in particular when being combined with elements as sensors, security, ranging, new materials etc.. These elements enable this technology to go by far beyond the pure "Identification" terminology. Based on that high potential, RFID is seen as a candidate for the realization of completely ubiquitous "ad-hoc" wireless and ambient intelligent networks.

At the same time it is essential to understand that the topic of RFID is a multidisciplinary and application specific one, which holds a variety of challenges for actual and future research. Aspects like globally valid standards and frequency bands, maximum achievable readrates in different applications, proximity of different materials as metals or bio-materials, achievable range, ultra-low power IC's, ultra low cost and finally security and privacy are to be mentioned.

Therefore this workshop will discuss current research and latest developments of RFID technologies and systems. It will highlight innovative concepts for application specific design, challenges and achievements in IC design, localization and sensing techniques as well as multi-standard ability. Further, new materials and technologies for low-cost RFID's will be presented.

#### Programme

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|----------------------|--|
| <b>8:45 - 9:35</b>   | <b><i>Current Trends and Future Developments of Passive RFID Technologies</i></b><br>Robert Weigel, U Erlangen-Nuremberg, Germany                            |
| <b>9:35 - 10:25</b>  | <b><i>Application Specific RFID System Design</i></b><br>Harald Witschnig, NXP, Austria  |
| <b>10:25 - 10:45</b> | <b><i>Coffee Break</i></b>   |
| <b>10:45 - 11:30</b> | <b><i>Secure Passive RFID Tags Enable the Internet of Things</i></b><br>Manfred Aigner, TU Graz, Austria   |
| <b>11:30 - 12:15</b> | <b><i>Multi-Standard RFID Transponder</i></b><br>Gerald Holweg, Infineon, Austria  |
| <b>12:15 - 13:00</b> | <b><i>Nonlinear Analysis and Measurement Techniques</i></b><br>Jochen Eßel, University of Erlangen-Nürnberg, Germany   |
| <b>13:00 - 14:00</b> | <b><i>Lunch</i></b>  |
| <b>14:00 - 14:50</b> | <b><i>Modern Design Concepts for RFID Antennas</i></b><br>Bernd Geck, University of Hannover, Germany  |
| <b>14:50 - 15:40</b> | <b><i>Green Enhanced-Range Paper-Based RFID's and Sensors for Ubiquitous Cognition Applications</i></b><br>Manos Tentzeris, Georgia Inst. Of Technology, USA |
| <b>15:40 - 16:10</b> | <b><i>Coffee Break</i></b>   |
| <b>16:10 - 17:00</b> | <b><i>Infrastructure-Independent Location Scheme and Visualization of RFID</i></b><br>Sebastian Kunkel, Siemens, Germany                                     |
| <b>17:00 - 17:50</b> | <b><i>Security in RFID HF Tags</i></b><br>Alexander Kurz, Atmel, Germany   |

8:45 to 17:50

Room: lustina

## WFMO2 (EuMC/EuWiT)

### Tunable RF-Components and Modules for Wireless Communication: Materials and Packaging

#### Organisers:

Holger Maune, Technische Universität Darmstadt, Germany  
Roberto Sorrentino, University of Perugia, Italy  
Rolf Jakoby, Technische Universität Darmstadt, Germany  
Robert Weigel, University of Erlangen-Nürnberg, Germany

#### Abstract

This workshop highlights the current research and development efforts in the design, the implementation and the packaging of frequency-agile RF devices and components based on tunable materials and micromechanical systems. It is aimed for reconfigurable RF-front-ends in particular for wireless communications. The workshop will cover all important topics from the material engineering process up to their application. It introduces different concepts for continuously tunable RF devices based on functional materials such as Barium-Strontium-Titanate (BST) and Liquid Crystals (LC). Therefore, one focus will be on the material engineering process, including material synthesis. Also switched devices namely RF-MEMS will be addressed. Another focus is on frequency-agile and switching components such as tunable phase shifters, tunable filters, tunable duplexers, adaptive matching networks, reconfigurable or frequency-agile antennas, electronically steered reflect-arrays and adaptive matched power amplifiers.

#### Programme

- 8:45 - 9:00** *Introduction / Welcome*
- 9:00 - 9:40** *Reconfigurable Communication Front-ends Based on RF-MEMS Switches*  
Volker Ziegler, EADS Innovation Works, Germany
- 9:40 - 10:25** *Liquid Crystals for Reconfigurable Microwave and Millimeterwave Applications*  
Felix Gölden, Technische Univ. Darmstadt, Germany
- 10:25 - 11:00** *Coffee Break*
- 11:00 - 11:35** *LTCC Packaging and Integration Technologies*  
Rüdiger Follmann, IMST GmbH, Kamp-Lintfort, Germany
- 11:35 - 12:10** *Recent Advances on Millimetre Wave Reconfigurable Reflect-Arrays*  
Roberto Vincenti Gatti, University of Perugia, Perugia, Italy
- 12:10 - 12:40** *Agile Microwave Dielectrics: Are there Other Alternatives to Ba<sub>x</sub>Sr<sub>1-x</sub>TiO<sub>3</sub>?*  
Spartak Gevorgian, Chalmers Univ. of Technology, Sweden
- 12:40 - 14:00** *Lunch*
- 14:00 - 14:35** *Tunable RF-Modules Based on Ferroelectric Thick-Film Ceramics - Material Synthesis and Film Deposition*  
Florian Paul, University of Freiburg, Germany
- 14:35 - 15:10** *Tunable RF-Modules Based on Ferroelectric Thick-Film Ceramics - Components and Applications*  
Mohsen Sazegar, Technische Univ. Darmstadt, Germany
- 15:10 - 15:40** *Different Strategies for the Implementation of Tunable Metamaterial Transmission Lines and Applications*  
Ferran Martín, Univ. Autònoma de Barcelona, Spain
- 15:40 - 16:10** *Coffee Break*
- 16:10 - 16:45** *Reconfigurable Front-End Modules Based on Ferroelectric Varactors*  
Robert Weigel, Univ. of Erlangen-Nuremberg, Germany
- 16:45 - 17:20** *Tunable Switch-Mode Power Amplifiers*  
Olof Bengtsson, Ferdinand-Braun-Institut für Höchstfrequenztechnik, Berlin, Germany
- 17:20 - 17:50** *Panel Discussion with Speakers and Attendees*



8:45 to 12:45 Room: Livia

## WHM03 (EuMIC)

### Nonlinear Noise Modelling and Large-Signal Low-Noise Microwave Circuit Design

#### Organisers:

Matthias Rudolph, Ferdinand-Braun Institut (FBH), Berlin, Germany  
Fabio Filicori, University of Bologna, Italy

#### Abstract

This workshop is focussed on recent developments in the field of nonlinear noise models and design techniques for low-noise microwave circuits which are intrinsically subject to large-signal operating conditions. In fact, many of the fundamental building blocks for the development of high-performance communication systems, like low-phase-noise oscillators, mixers or interference-robust low-noise amplifiers, are subject to important noise generation phenomena which are strongly conditioned by the presence of large-amplitude signals. In such cases, normally characterized by periodic or almost periodic non-linear operation, noise modelling in electron devices becomes much more complex, in comparison with the linear steady-state case, since cyclostationary, instead of conventional, stationary equivalent noise sources must be considered in the device models or low-noise circuit design.

In this workshop, after outlining the basics of noise generation in semiconductors and of numerical physics-based noise models, non linear, compact HBT and FET non-linear noise models will be described with examples of application to noise analysis in non linear microwave circuits. Design approaches for low-noise oscillators, mixers and amplifiers will also be presented and discussed.

#### Programme

<b>8:45 - 9:20</b>	<b><i>Physics-Based Nonlinear Noise Modelling</i></b> Fabrizio Bonani, Politecnico di Torino, Italy
<b>9:20 - 9:55</b>	<b><i>Non-Linear HBT Noise Modelling and Applications</i></b> Christophe Nallatamby, Univ. Limoges, France
<b>9:55 - 10:30</b>	<b><i>Non-Linear FET Noise Modelling and Applications</i></b> C.Florian, P.A.Traverso, F. Filicori, Univ. Bologna, Italy
<b>10:30 - 11:00</b>	<b><i>Coffee Break</i></b>
<b>11:00 - 11:35</b>	<b><i>Low Phase-Noise Oscillator Design Techniques, Applications and Future Trends</i></b> U. L. Rohde, Univ. Cottbus, Germany Ajay K. Poddar, Synergy Microwave Corp., NJ, USA
<b>11:35 - 12:10</b>	<b><i>Noise in Mixers</i></b> Steven Maas, AWR, USA
<b>12:10 - 12:45</b>	<b><i>Highly Linear Low-noise Amplifiers</i></b> Matthias Rudolph, Ferdinand-Braun-Inst. (FBH), Germany
<b>12:45 - 14:00</b>	<b><i>Lunch</i></b>

8:45 to 12:40 Room: Minerva

## WHM04 (EuMC/EuMIC)

### Advanced Non-Linear Characterization of RF and Microwave Components

#### Organisers:

Giovanni Ghione, Polytechnic of Turin, Italy  
 Andrea Ferrero, Polytechnic of Turin, Italy

#### Abstract

The modelling and characterization of nonlinear microwave devices and systems like power amplifiers, mixers and oscillators has been a hot topic during the last few years. The evolution of characterization techniques has opened the way to more refined modelling approaches, allowing for memory effects and complex device dynamics, while the progress in modelling framework has in turn stimulated the development of new and unconventional characterization techniques. At the same time, the increasing demand of multiport characterization has fostered the development of multi-port and differential load-pull measurement techniques.

The purpose of the workshop is to present an overview of the state of the art in this field with contributions on recent developments from some of the top research groups operating in Europe and in the USA.

The presentations will focus on advanced load-pull techniques, large-signal characterization in the presence of broadband signals, characterization and modelling of memory effects, not to mention the emerging topic of noise measurements in large-signal conditions.

#### Programme

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|----------------------|---|
| <b>8:45 - 9:10</b>   | <b><i>The Effect of Harmonic Terminations Variation on the Accuracy of Load Pull Measurements</i></b><br>Basim Noori, Freescale Semiconductor Inc., USA                             |
| <b>9:10 - 9:35</b>   | <b><i>A Mixed-Signal Approach for Large-Signal Device Characterisation with Wideband Modulated Signals</i></b><br>M. Spirito, Delft University of Technology, The Netherlands       |
| <b>9:35 - 10:00</b>  | <b><i>Active Harmonic Differential/ Common-Mode Load-Pull with Timedomain Waveform Capabilities</i></b><br>V. Teppati, Polytechnic of Turin, Italy                                  |
| <b>10:00 - 10:25</b> | <b><i>Active Load-Pull Using Broadband Signals</i></b><br>Holger Arthaber, TU Wien, Austria   |
| <b>10:25 - 11:00</b> | <b><i>Coffee Break</i></b>  |
| <b>11:00 - 11:25</b> | <b><i>Nonlinearity Spotting for Dummies</i></b><br>Wendy Van Moer, Vrije Universiteit Brussel, Belgium  |
| <b>11:25 - 11:50</b> | <b><i>Characterisation of SDR Transmitters in Presence of Multisines</i></b><br>P. M. Cruz, University of Aveiro, Portugal  |
| <b>11:50 - 12:15</b> | <b><i>NVNA Measurements for RF Power Transistor LF Memories Analysis</i></b><br>Jean-Pierre Teyssier, XLIM, University of Limoges, France   |
| <b>12:15 - 12:40</b> | <b><i>Noise Measurements for Microwave Electron Device Characterisation and Modelling under Non-linear Operating Conditions</i></b><br>P. A. Traverso, Università di Bologna, Italy |
| <b>12:40 - 14:00</b> | <b><i>Lunch</i></b>   |

## MONDAY WORKSHOPS AND SHORT COURSES



8:45 to 17:15 Room: Niside

### WFM05 (EuMC)

#### Advanced Topics in Design and Realization of Microwave Filters

##### Organisers:

Giuseppe Macchiarella, Polytechnic of Milan, Italy  
Richard V. Snyder, RS Microwave, USA

##### Abstract

Modern communications systems require increasingly sophisticated microwave filters. Selectivity and miniaturization, combined with relatively low passband losses, are becoming a must in new systems. Thus, the designer is often required to compromise between several contrasting requirements. This workshop will present a comprehensive overview of recent advances in some of the most promising application area of microwave filters; innovative solutions concerning both design approaches and technological achievement will be presented.

##### Programme

<b>8:45 - 9:00</b>	<b>Welcome and Introduction</b> G. Macchiarella, Polytechnic of Milan, Italy
<b>9:00 - 9:40</b>	<b>Present and Future of Filter Design Philosophy</b> R. Snyder, RS Microwave, USA
<b>9:45 - 10:20</b>	<b>New Approach to Dual-Mode Filters Design</b> S. Amari, Royal Military College, Canada
<b>10:25 - 11:00</b>	<b>Coffee Break</b>
<b>11:00 - 10:30</b>	<b>Recent Achievements on SIW Filtering Structures</b> K. Wu, University of Montreal, Canada
<b>11:35 - 12:05</b>	<b>Recent Achievements in Miniaturized Tunable Filters</b> I. Hunter, University of Leeds, United Kingdom
<b>12:10 - 12:40</b>	<b>Micro-Machined and Dielectric Resonators Tunable Filters</b> R. Mansour, University of Waterloo, Canada
<b>12:40 - 14:00</b>	<b>Lunch</b>
<b>14:00 - 14:30</b>	<b>Advances on Lossy and Predistorted Filters Design and Applications</b> M. Yu, COM DEV, Canada
<b>14:35 - 15:05</b>	<b>Innovative Design Solutions for Waveguide Filters</b> S. Bastioli, Università di Perugia, Italy
<b>15:10 - 15:40</b>	<b>Recent Achievements in Filters for Space Communications</b> V. Boria, Universidad Politéc. Valencia, Spain
<b>15:40 - 16:10</b>	<b>Coffee Break</b>
<b>16:10 - 16:40</b>	<b>Synthesis Techniques on Multiband Filters</b> F. Seyfert, INRIA, France
<b>16:45 - 17:15</b>	<b>New Combiner Topologies for Mobile Communications Base Stations</b> S. Tamiazzo, Andrew Telecommunication Products, Italy

8:45 to 17:50 Room: Ottavia

## WFM06 (EuMC)

### Recent Advances on Microwave Applications of Metamaterial Concepts

#### Organisers:

Ferran Martín, Universitat Autònoma de Barcelona, Spain  
Lucio Vegni, University of Rome 'Roma TRE', Italy

#### Abstract

The purpose of this Workshop is to point out and highlight the recent advances on the applications of Metamaterials and related concepts to Microwave Engineering. Since the "big-bang" of Metamaterials in 2000, there has been an intensive research activity towards the application of novel ideas inspired on the unique properties of Metamaterials in the field of microwave engineering and telecommunications. Thus, in the recent years, we have seen significant progress concerning microwave circuit, device and antenna design in terms of miniaturization, performance improvement, multi-functionality, efficiency, etc, and Metamaterial's Technology is progressively achieving a level of maturity in Microwave Engineering that "real-life" applications and "penetration" to the market may be envisaged. The workshop will cover the fundamental aspects concerning the design of microwave circuits, devices and antennas based on Metamaterials and related concepts, with special emphasis on the novel achievements by the speakers and their respective Groups in the field. Novel artificial lines and their microwave applications, transmission line Metamaterials, Metamaterial analog signal processing, tunable components, filters, electrically small antennas and impedance surfaces, among others, are the main topics. All the Invited Speakers have significantly contributed to the progress of Metamaterial's Technology applied to Microwave Engineering, and have international recognition at the highest level. Five books related to Metamaterials and complex media have been authored or co-authored by several of the workshop contributors. It is also the purpose of this workshop to discuss future trends and directions in the field.

#### Programme

<b>8:45 - 9:35</b>	<b><i>Recent Advances in Composite Right/Left Handed Metamaterial Structures</i></b> Tatsuo Itoh, University of California Los Angeles (UCLA), USA
<b>9:35 - 10:25</b>	<b><i>Recent Advances in Transmission-Line Metamaterials and their Applications</i></b> George V. Eleftheriades, University of Toronto, Canada
<b>10:25 - 11:00</b>	<b><i>Coffee Break</i></b>
<b>11:00 - 11:50</b>	<b><i>Metamaterial Analog Signal Processing</i></b> Christophe Caloz, École Polytechnique Montréal Canada
<b>11:50 - 12:40</b>	<b><i>Recent Advances on Resonant Type Metamaterial Transmission Lines and Applications</i></b> Ferran Martín and Jordi Bonache, Univ. Autònoma de Barcelona, Spain.
<b>12:40 - 14:00</b>	<b><i>Lunch</i></b>
<b>14:00 - 14:50</b>	<b><i>Tunable Multi-Band Microwave Resonators and Filters with Positive and Negative Dispersion</i></b> Irina Vendik, St. Petersburg Electrotechnical University, Russia
<b>14:50 - 15:40</b>	<b><i>Passive and Active Metamaterial Constructs and their Impact Electrically Small Antennas</i></b> Richard Ziolkowski, University of Arizona, USA
<b>15:40 - 16:10</b>	<b><i>Coffee Break</i></b>
<b>16:10 - 17:00</b>	<b><i>Miniaturized Multifunctional Microwave Antennas Based on Metamaterials</i></b> Filiberto Bilotti and Lucio Vegni, University "Roma Tre", Italy
<b>17:00 - 17:50</b>	<b><i>Recent Advances in Artificial High Impedance Surfaces and Applications</i></b> S.Tretyakov, O.Luukkonen and C. Simovski, Helsinki Univ. of Technology, Finland

## MONDAY WORKSHOPS AND SHORT COURSES



14:00 to 17:50 Room: Livia

### WHM07 (EuMC)

#### Advanced Solutions for Signal Integrity in Densely Integrated High-Frequency Systems

##### Organiser:

Roberto Antonicelli, ST-Ericsson, Belgium  
Mauro Caule, ST-Ericsson, Belgium

##### Abstract

Design community is today challenged to find new ways to efficiently integrate different wireless communication systems into a small portion of space. The resulting mutual cross-coupling, emphasized by the close vicinity, may end up in fatal effects on one another wireless device.

Currently available tools for simulation and modelling do not allow an easy and rational allocation and mapping of planar silicon devices into new constructions, thus limiting the speed and the accuracy in heterogeneous design phase.

In this workshop, several authors from the industry will introduce and debate about advanced packaging, interference and cross-coupling, new techniques of analysis and modelling and co-design of silicon, package, PCB.

##### Programme

- 14:00 - 14:30** *High Speed Multi-Chip Challenges: Through Silicon Vias (TSV), Micro-Bumps and Embedded Structures*  
Carlo Cognetti De Martiis, STMicroelectronics, Switzerland
- 14:35 - 15:05** *A Methodology Using Parameterized Embedded Passive Components (PCells) for RF Filters in the System in Package Substrate Design*  
Martin Biehl, Cadence AG, Germany
- 15:10 - 15:40** *Design and Optimization of High Performance FBGA for Wireless Application*  
Massimo Capodiferro, Ansoft Corporation, Italy
- 15:40 - 16:10** *Coffee Break*
- 16:10 - 16:40** *Multi-Source RF System in Package Design Methodology*  
Christopher Barrat, Insight SiP, France
- 16:45 - 17:15** *An Integrated 3DEM Flow for the Design of High Performance RF Electronic Devices*  
Saliou Dieye, Agilent Corporation, France
- 17:20 - 17:50** *A Complete Technology Approach for 3D EM Signal Integrity Analysis*  
Leonardo Sassi, Edoardo Genovese, CST AG, Germany

# MONDAY WORKSHOPS AND SHORT COURSES

14:00 to 17:50 Room: Minerva

## European Radio and Microwave Interest Group "EuRaMIG" Workshop Microwave for European Growth

Chairman: Franz Dielacher, Infineon Technologies Austria AG

### Background

RF/microwave technology is an indispensable part of all aspects of our lives including wireless telecommunication, safety and security, healthcare, test and measurement, weather forecast, intelligent transport systems, global positioning, radio frequency identification, radio astronomy, earth observation, space, training and defense.

From the microwave techniques developed over more than one century ago, an industry has emerged as essential as microelectronics and the car industry. The microwave industry is the never ending system exploitation of the electromagnetic field from 300 MHz up to 300 GHz. In that respect it is merging with photonics into what can be called microwave photonics or Terahertz technology.

The biggest success of the microwave industry so far has been the mobile revolution. It has created the possibility for real time communications at any time and from any place.

Future microwave development opportunities are always difficult to anticipate, but will most likely result from the way human-beings interact socially, culturally, politically and economically. In particular environmental issues as well as threats and disasters will require new microwave solutions.

However, the microwave industry has long been a complex network of interdependencies between component manufacturers, subsystem houses, and large-scale microwave equipment companies. The advent and fast development of mobile telecommunication, is forcing all these actors to work out altogether a coherent supply chain and Moore's like roadmaps to ensure that R&D activities, marketing and investment are positively unified. This can be seen as a prerequisite to a successful microwave industry in Europe in the coming decades.

### Scope

The workshop is to provide an overview on the European microwave technology roadmap, its application scenario, and its relevance to the society within Europe. Comments and suggestions will be highly appreciated and taken into consideration in the vision and roadmap papers.

### Speakers

Industry representatives and leading edge researchers will be the presenters of hot topics such as microwave potential, vision and roadmap as well as business related issues in the RF- and Microwave area in Europe. The workshop will conclude with a panel discussion with the speakers as panellists.

### Programme

- 14:00 - 14:15** *Welcome and Introduction*
- 14:15 - 15:40** *Position and Vision of European Microwave Industry*  
Mobile Communication  
Energy and Environment  
Medicine and Health  
Safety and Security  
Scientific Use of Microwaves
- 15:40 - 16:10** *Coffee Break*
- 16:10 - 17:10** *A European Microwave Roadmap*  
Application Segments and Supply Chain  
Key Enablers  
Facts and Figures  
Strengths and Weaknesses in Europe  
How to Improve?
- 17:10 - 17:50** *Panel Discussion*
- 17:50** *Closing Remarks*

### Attendance

All RF/Microwave engineers from industry and academia, including students, are invited to attend and to participate actively in the Workshop sharing their opinions and suggestions. There is no fee for attending this workshop

The European Radio and Microwave Interest Group (EuRaMIG) [www.euramig.org](http://www.euramig.org) has been launched as a network of companies, institutes and universities in Europe to gather around common visions and objectives for Europe in RF/microwave technology.

It is recommended to join the European Microwave Association (EuMA) <http://eumwa.org> as a member because this will further support and strengthen EuRaMIG and the microwave community in Europe.



8:45 to 12:40 Room: Livia

**WHWE8 (EuMIC/EuMC)**

**Advances in RF-MEMS Reliability**

**Organisers:**

Pierre Blondy, XLIM CNRS Université de Limoges, France  
George Papaioannou, NKUA Athens, Greece  
John Papapolymerou, Georgia Tech, USA

**Abstract**

RF-MEMS have long been expected to enter mass market for many applications where their low loss, low power consumption and high linearity will allow dramatic improvements in many RF and microwave subsystems.

However, understanding the phenomena and laws that govern their lifetime is a serious challenge, since RF-MEMS have properties stemming from their mechanical nature, like contact aging, and others from their electronic nature, like charge trapping.

The purpose of this workshop is to present the latest results on the subject that have been obtained on RF-MEMS switches of all kinds, with emphasis on testing methodologies and relevant results for different kinds of RF-MEMS switches.

**Programme**

- 8:45 - 9:15**      ***Physics of Charging in Dielectrics and Reliability of Capacitive RF MEMS Switches***  
George Papaioannou, NKUA Athens, Greece  
John Papapolymerou, Georgia Institute of Technology, USA
- 9:15 - 9:50**      ***Reliability of Dielectric Less RF-MEMS Switches***  
Arnaud Pothier and Pierre Blondy,  
XLIM CNRS Univ. de Limoges, France
- 9:50 - 10:25**    ***Dielectric Charging in Capacitive MEMS Switches***  
James Hwang, Crisitano Palego Lehigh University, USA
- 10:25 - 11:00**    ***Coffee Break***
- 11:00 - 11:35**    ***New Tools and Methods to Assess Failure Mechanisms in RF-MEMS***  
Fabio Coccetti and Robert Plana, LAAS CNRS, France  
George Papaioannou, NKUA Greece
- 11:35 - 12:05**    ***Monocrystalline-Silicon Microwave MEMS Devices: Multi-Stable Switches W-Band Phase Shifters, and MEMS Tunable Frequency-Selective Surfaces***  
Joachim Oberhammer, KTH, Sweden
- 12:05 - 12:40**    ***Space Evaluation Strategy of RF MEMS: Focus on Harsh Environment Constraints***  
Olivier Vendier, Thales Alenia Space, Toulouse, France
- 12:40 - 14:00**    ***Lunch***

**8:45 to 17:50 Room: Minerva**

## WFWE9 (EuMC)

### From THz Devices to Systems: Design, Modelling, Processes and Characterisation

#### Organisers:

Dimitris Pavlidis, Technische Universität Darmstadt, Germany  
 Ali A. Rezazadeh, University of Manchester, UK  
 A. Maestrini, Observatoire de Paris, France  
 I. Mehdi, Jet Propulsion Laboratory, USA

#### Abstract

High frequency of operation is essential for many future systems of Information Society Technology (IST), such as, for example 80 and 160 Gb/s optical fibre transmission or broadband (>100 Gbits) wireless applications. In addition to IST applications, the development of sensors and detectors is of key importance for biological and biomedical applications, as well as, security and early warning systems utilizing gas detection. These require the evaluation of resonance frequencies of gases and biological molecules located in the millimeter and sub-millimeter spectral domain (hundreds of GHz to THz). The proposed tutorial will address various device approaches for THz applications and will cover their design, modeling, process and characterization aspects. The tutorial is prepared for young scientists and engineers interested in learning about this emerging field, as well as people with more advanced understanding of related concepts. Experts from both Europe and the US will present the current status and future prospects of key THz technologies. The workshop will explore all relevant technologies from the device level to the fully functioning system level.

#### Programme

<b>8:45 - 9:10</b>	<b><i>THz Applications</i></b> I. Mehdi, Jet Propulsion Laboratory, USA
<b>9:10 - 9:35</b>	<b><i>Silicon Micro-Machined Components for THz Applications</i></b> J. Papapolymerou, Georgia Institute of Technology, USA
<b>9:35 - 10:00</b>	<b><i>Semiconductor Signal Sources for THz Applications</i></b> D. Pavlidis, Univ. Darmstadt, Germany
<b>10:00 - 10:25</b>	<b><i>Wideband THz Frequency Multiplier Chains for Local Oscillators</i></b> Alain Maestrini, Univ. Paris 6, France
<b>10:25 - 11:00</b>	<b><i>Coffee Break</i></b>
<b>11:00 - 11:25</b>	<b><i>Low-Bandgap and Plasma Wave Transistors for THz Detection and Emission</i></b> S. Bollaert et al., IEMN, Lille, France
<b>11:25 - 11:50</b>	<b><i>Ballistics Nanodevices: Towards THz Applications</i></b> D. Vanhoenacker-Janvier, I. Huynen, UCL, Belgium
<b>11:50 - 12:15</b>	<b><i>Design and Realisation of Compact 3D MMIC Components for Future THz Applications</i></b> A. A. Rezazadeh, Univ. of Manchester, UK
<b>12:15 - 12:40</b>	<b><i>THz Quantum Cascade Lasers</i></b> A. Tredicucci, Scuola Normale Superiore, Pisa, Italy
<b>12:40 - 14:00</b>	<b><i>Lunch</i></b>
<b>14:00 - 14:25</b>	<b><i>Schottky Diode Technology for THz Applications</i></b> G. Chattopadhyay, Jet Propulsion Laboratory, USA
<b>14:25 - 14:50</b>	<b><i>Optoelectronic THz Signal Generation and Use in Component Characterisation</i></b> J. F. Lampin, (IEMN), France
<b>14:50 - 15:15</b>	<b><i>Sweep-Able Sub-Millimeter Sources and Detectors for THz Vector Network Analyzers and Applications</i></b> P. Goy, ABmillimetre, France
<b>15:15 - 15:40</b>	<b><i>Plasma-Wave Based THz Detection with Silicon CMOS Transistors: Direct Power Detection and Heterodyne Operation</i></b> A. Lissauskas, D. Glaab, S. Boppel, U. Pfeiffer, E. Öjefors and H. G. Roskos Wolfgang Goethe University and University of Wuppertal, Germany
<b>15:40 - 16:10</b>	<b><i>Coffee Break</i></b>
<b>16:10 - 17:35</b>	<b><i>Terahertz System Considerations</i></b> N. Whyborn, SRO, The Netherlands
<b>17:35 - 17:50</b>	<b><i>Conclusions and Discussions</i></b>

8:45 to 17:50 Room: Niside

WFWE10 (EuMC/EuMIC)

Advances in Gallium Nitride High Electron Mobility Transistors: Technology and Reliability

Organisers:

Umesh Mishra, University of California, Santa Barbara, USA  
Enrico Zanoni, University of Padova, Italy

Abstract

Gallium Nitride electronics currently represents the most promising technology for a number of extremely relevant applications, such as high efficiency, high frequency and high power communication systems, ultra wideband communication systems, radars, spaceborn systems, energy-efficient power switching applications, robust low-noise front-ends and high-temperature ultrascaled digital devices. During this workshop, a series of invited talks will review the most recent advances concerning GaN High Electron Mobility Transistors and related circuits, applications and reliability. The workshop will represent an open discussion forum for the international GaN microwave community; results from European project as well as from international research laboratories will be presented.

Programme

<b>8:45 - 9:00</b>	<b>Introduction</b> Umesh Mishra, UCSB, USA Enrico Zanoni, Univ. Padova, Italy
<b>9:00 - 9:50</b>	<b>GaN HEMT RF Power Electron ICs</b> Michael Mikulla, IAF Fraunhofer, Germany
<b>9:50 - 10:25</b>	<b>GaN HEMT Research within the KORRIGAN Project</b> Philippe Dueme, TAS, France
<b>10:25 - 11:00</b>	<b>Coffee Break</b>
<b>11:00 - 11:45</b>	<b>InAlN/InGaN HEMT Technology</b> Sylvain Delage, III-V Labs, France
<b>11:45 - 12:30</b>	<b>Progress of Highly-Reliable GaN HEMT for Next Generation Application</b> Toshihide Kikkawa et al., Fujitsu, Japan
<b>12:30 - 14:00</b>	<b>Lunch</b>
<b>14:00 - 14:20</b>	<b>GaN-HEMT Technology Development for Next Generation AESA Systems Applications</b> Antonio Cetronio, Selex-SI, Italy
<b>14:20 - 15:00</b>	<b>Parasitic Effects in GaN HEMTs and Related Characterization Methods</b> Gaudenzio Meneghesso et al., Univ. of Padova, Italy
<b>15:00 - 15:40</b>	<b>Micro-Raman Thermography and Related Techniques for GaN HEMT Characterisation</b> M. Kuball et al., Univ. of Bristol, UK
<b>15:40 - 16:10</b>	<b>Coffee Break</b>
<b>16:10 - 16:40</b>	<b>GaN HEMTs Characterisation and Testing: Deep Level Transient Spectroscopy Diagnostics</b> Alessandro Chini, Univ. of Modena, Italy
<b>16:40 - 17:20</b>	<b>GaN HEMT Modelling and Reliability Analysis by Means of 2D Device Simulations</b> Giovanni Verzellesi, Univ. Modena and Reggio Emilia, Italy
<b>17:20 - 17:40</b>	<b>Conclusions</b>

14:00 to 17:50 Room: Euphemia

**WHWE11 (EuMC)**

**Practical Approaches to Achieving Confidence in Microwave Measurements**

**Organisers:**

Andrej Rumiantsev, SUSS MicroTec, Germany  
 Daniel Pasquet, LaMIPS, France  
 Dave Blackham, Agilent Technologies, USA

**Abstract**

Following the recent successful workshop series on uncertainties in microwave measurements, from Microwave Weeks 2006-2008 this workshop will continue presenting practical information on evaluating accuracy of measurements made at RF and microwave frequencies.

In particular, this workshop will be built on the idea to demonstrate a top-down approach for evaluating uncertainty of measured values. Also, it will give an update on the latest achievements in this field. Specific talks will explore new rapidly developing areas, such as time domain load-pull and measurement of frequency converting devices.

**Programme**

<b>14:00-14:25</b>	<b><i>Evaluating Measurement Uncertainty for Complex-Valued Quantities</i></b> Nick Ridler, NPL, UK
<b>14:25-14:50</b>	<b><i>A Practical Guide to S-Parameter Measurement Uncertainty Calculation</i></b> D. Blackham, Agilent Technologies, USA
<b>14:50-15:15</b>	<b><i>Confident S-Parameter Measurements at the Wafer-Level</i></b> Andrej Rumiantsev, SUSS MicroTec, Germany
<b>15:15-15:40</b>	<b><i>Noise Figure Uncertainties in the Cold Source Method</i></b> Bob Shoulders, Agilent Technologies, USA
<b>15:40-16:10</b>	<b><i>Coffee Break</i></b>
<b>16:10-16:30</b>	<b><i>Measurement Uncertainties on Noise Parameters for an Active Device</i></b> Daniel Pasquet, LaMIPS, France
<b>16:30-17:10</b>	<b><i>Identifying Uncertainty in Measurements of Frequency Converting Devices</i></b> Joel Dunsmore, Agilent Technologies, USA
<b>17:10-17:50</b>	<b><i>Uncertainty of Time Domain Load-Pull Measurements</i></b> J. Verspecht, Verspecht-Teyssier-DeGrootte s.a.s, Belgium

8:45 to 17:50 Room: Euphemia

## WFTH12 (EuMC)

### Bridging Radio-Frequency and Nanotechnology: A New Generation of RF-Nanocomponents, Systems and NEMS

#### Organisers:

Luca Pierantoni, Polytechnic University of Marche, Ancona, Italy  
Mircea Dragoman, IMT, Bucarest, Romania  
Fabio Coccetti, CNRS, Toulouse, France  
Manos M. Tentzeris, Georgia Tech, Atlanta, GA, USA

#### Abstract

Nanotechnology offers a promising multitude of new ultraminiaturized devices with potential sensing, thermal, electronic applications at microwave and radio frequencies (RF).

Among others, carbon nanotubes (CNT) and graphene nanoribbons (GNR) are nanoscale structures that exhibit unique mechanical and electrical properties, such as ultra-high mobility, high saturation velocity, high current carrying capability, easy controllability of the band gap, excellent thermal conductivity, ultra-thin geometry, and exceptional Young modulus. In addition, carbon based material has also been found to be extremely sensitive to several gases, thus enabling a new generation of wireless sensor devices.

The goal of this workshop is to present recent research achievements on high-performance devices for radio frequency applications, based on the assembly of novel nano-components, as well as on potential techniques exploiting radio waves in nanotechnology.

High-frequency electromagnetic waves can be used to probe in a non-invasive/non-destructive way the properties of materials and devices based on nanostructures. The new devices find interesting wireless and RF applications, such as nanoscale electro-mechanical switches (NEMS), microscope tips, nano-antennas and interconnects.

The topics cover issues ranging from epitaxial graphene patterning for the production of carbon based transistors, RF molecular electronics, ballistic resonance/transport through heterostructures, electromagnetic effects in carbon nanotubes, to recent advances in nanoscale imaging using microwave fields.

Particular attention will also be devoted to new measurements techniques in the broadband characterization of nanoscale systems.

#### Programme

<b>8:45 - 9:30</b>	<b><i>CNT Based Devices for Sensing and Communication Applications</i></b> Mircea Dragoman, IMT, Bucarest, Romania
<b>9:30 - 10:15</b>	<b><i>Carbon Nanotube Nano-Electro-Mechanical Switches</i></b> Adrian M. Ionescu, Nanolab, Ecole Polytechnique Fédérale de Lausanne, Switzerland
<b>10:15 - 11:00</b>	<b><i>Broadband Characterisation of High Impedance Nanoscale Systems</i></b> P. Kabos, National Institute of Standards and Technology, Boulder, CO, USA
<b>11:00 - 11:30</b>	<b><i>Coffee Break</i></b>
<b>11:30 - 12:15</b>	<b><i>Using Evanescent Microwave Fields for Nanoscale Imaging</i></b> Marco Farina, Univ.Polit. delle Marche, Ancona, Italy
<b>12:15 - 13:00</b>	<b><i>THz Signal Generation by Quasi-Ballistic Resonance Charge Swing in Heterostructures - a New Concept</i></b> Hans L. Hartnagel, Nanolab, Tec. Univ. Darmstadt, Germany
<b>13:00 - 14:00</b>	<b><i>Lunch</i></b>
<b>14:00 - 14:45</b>	<b><i>Ultrasensitive Wireless Gas Sensing Nodes Utilizing Carbon Nanotubes and Graphene Nano-Ribbons</i></b> Trang T. Thai, Georgia Inst. of Tech. Atlanta, GA, USA
<b>14:45 - 15:30</b>	<b><i>Arrays of SWNT Devices for Analog RF: Overview of the Field</i></b> Peter Burke, University of California, Irvine CA, USA
<b>15:30 - 16:00</b>	<b><i>Coffee Break</i></b>
<b>16:00 - 16:45</b>	<b><i>Towards an RF Molecular Electronics</i></b> Paolo Lugli, Universität München, Munich, Germany
<b>16:45 - 17:30</b>	<b><i>Electromagnetic Effects in Carbon Nanotubes: Modelling, Potential Device Applications and Open Questions</i></b> Sergey A. Maksimenko, Belarus State University, Minsk, Belarus

8:45 to 17:50 Room: Livia

## WFTH13 (EuMC/EuRAD)

### Advances in UWB Localization and Sensing

#### Organisers:

Thomas Kaiser, University of Hannover, Germany  
 Reinhard Knöchel, University of Kiel, Germany  
 Jürgen Sachs, TU Ilmenau, Germany  
 Robert Weigel, University of Erlangen-Nürnberg, Germany

#### Abstract

This workshop will highlight current research and latest developments of UWB-technology for short range localization, positioning and sensing. It will cover advances in dedicated UWB-electronics, localization and positioning approaches, UWB-sensors and sensing networks as well as related signal processing for industrial, medical and automotive applications. The exploitation of the benefits and advantages of ultra-wide bandwidth signals with respect to measurement accuracy, spatial, spectral and spectroscopic resolution as well as robust signal propagation will be demonstrated. The workshop includes several reports on medical UWB applications. Novel UWB techniques will be introduced and their performance will be demonstrated by way of a few examples such as the HALOS system or the EUROPCOM system.

#### Programme

<b>8:45 - 9:25</b>	<b>79 GHz UWB Radar Sensor</b> A. Stelzer, C. Wagner and R. Feger, University of Linz, Austria
<b>9:25 - 9:55</b>	<b>A UWB Real-Time Millimeter 3-D Wireless Positioning System</b> M. Kuhn, M. Mahfouz and A. Fathy, University of Tennessee, Knoxville, USA
<b>9:55 - 10:25</b>	<b>Evaluation of Localization Measurements in LoS and NLoS Scenarios Using Antenna Arrays</b> S. Sczyslo and T. Kaiser, University of Hannover, Germany
<b>10:25 - 11:00</b>	<b>Coffee Break</b>
<b>11:00 - 11:40</b>	<b>Embedded Waveform Generation and Spectral Analysis for Ultra Wide Band Signal Applications</b> J. Laskar, K. Lim and S. Pinel Georgia Inst. of Technology, Atlanta, USA
<b>11:40 - 12:10</b>	<b>Real-Time UWB Positioning in Complex Environments Based on Chopped FMCW</b> R. Weigel and B. Waldmann Univ. of Erlangen-Nuremberg, Germany
<b>12:10 - 12:40</b>	<b>UWB-Electronics for Local Positioning</b> L. Wiebking, Siemens, Munich, Germany
<b>12:40 - 14:00</b>	<b>Lunch</b>
<b>14:00 - 14:40</b>	<b>Spectroscopic Ultra Wide Band Sensing Techniques</b> R. Knöchel, University of Kiel, Germany
<b>14:40 - 15:10</b>	<b>The UWB Indoor Positioning System EUROPCOM</b> A. Yarovoy, Delft Univ. of Technology, The Netherlands
<b>14:40 - 15:10</b>	<b>M-Sequence Ultra Wide Band Technologies: The HALOS Project</b> J. Sachs, University of Ilmenau, Germany
<b>15:40 - 16:10</b>	<b>Coffee Break</b>
<b>16:10 - 16:50</b>	<b>Compact I-UWB Frontends for Medical Sensing and Imaging</b> H. Schumacher, B. Schleicher, D. Lin, M. Leib and W. Menzel University of Ulm, Germany
<b>16:50 - 17:20</b>	<b>Ultra Wideband Sensing System of Breast Tumors</b> V. Zhurbenko, T. Rubaek and V. Krozer, Technical University of Denmark, Lyngby, Denmark
<b>17:20 - 17:50</b>	<b>UWB-Based Medical Geolocation</b> R. Kohno, University of Yokohama, Japan



8:45 to 17:50 Room: Minerva

## SFTH1 (EuMIC)

### Fundamental of Microwave Power Amplifier Designs

#### Organisers:

Ali A. Rezazadeh, University of Manchester, UK  
 Franco Giannini, University of Rome 'Tor Vergata', Italy

#### Abstract

Power amplifiers are a key component of the circuitry that drives radio frequency and microwave transmission and have received a great deal of attention and development effort over the last decade. This course provides a comprehensive overview of all aspects of fundamental microwave power amplifiers designs. The course is introductory, aimed at graduate engineers who have moved into the field of RF design. The speakers are experts in these areas from well known recognised organisations.

#### Programme

<b>8:45 - 9:00</b>	<b><i>Welcome and Introduction</i></b>
<b>9:00 - 9:40</b>	<b><i>Power Amplifier Fundamentals</i></b> Tom Brazil, UC Dublin, Ireland
<b>9:40 - 10:25</b>	<b><i>Microwave Transistor Technologies</i></b> Ali A. Rezazadeh, University of Manchester, UK
<b>10:25 - 11:00</b>	<b><i>Coffee Break</i></b>
<b>11:00 - 12:40</b>	<b><i>Small and Large Signal Models and Algorithms</i></b> Giorgio Leuzzi, Università dell'Aquila, Italy
<b>12:40 - 14:00</b>	<b><i>Lunch</i></b>
<b>14:00 - 14:50</b>	<b><i>High Efficiency Microwave Amplifiers</i></b> Franco Giannini, University of Rome "Tor Vergata", Italy
<b>14:50 - 15:40</b>	<b><i>Design Techniques</i></b> Peter de Hek, Frank Van den Bogaart, TNO, The Netherlands
<b>15:40 - 16:10</b>	<b><i>Coffee Break</i></b>
<b>16:10 - 17:00</b>	<b><i>Advanced PA Concepts: Dual-Band PA</i></b> Alessandro Cidronali, University of Florence, Italy Paolo Colantonio, University of Rome "Tor Vergata", Italy
<b>17:00 - 17:20</b>	<b><i>Discussion and Conclusions</i></b>

## THURSDAY WORKSHOPS AND SHORT COURSES



8:45 to 17:50 Room: Niside

SFTH2 (EuMIC/EuMC)

### Review of FET Modelling for Emerging High-Efficiency and Wideband Circuit Applications

#### Organisers:

Iltcho Angelov, Chalmers University of Technology, Sweden  
Dominique Schreurs, K. U. Leuven, Belgium

#### Abstract

FET devices are a key component of microwave and millimetre wave circuitry aimed at a wide variety of existing and emerging base-station and wireless applications. This course provides a comprehensive overview of all important aspects of FET device characteristics, small-signal and large signal measurements and modelling. Special attention is paid to topics and practical aspects which usually are not covered in details in scientific literature. The short course includes detailed coverage of subjects such as model extraction and implementation, dispersion phenomena, breakdown, packaging, and LSVNA use for model extraction.

#### Programme

<b>8:45 - 9:00</b>	<b><i>Welcome and Introduction</i></b>
<b>9:00 - 10:00</b>	<b><i>Characterisation and Modeling Techniques for High-Efficiency Switched Mode PA Design</i></b> C. Fager, Chalmers University, Sweden
<b>10:00 - 10:25</b>	<b><i>Empirical Nonlinear IV and Capacitances Models and LS Model Implementation (I)</i></b> I. Angelov, Chalmers University, Sweden
<b>10:25 - 11:00</b>	<b><i>Coffee Break</i></b>
<b>11:00 - 11:40</b>	<b><i>Empirical Nonlinear IV and Capacitances Models and LS Model Implementation (II)</i></b>
<b>11:40 - 12:40</b>	<b><i>Measurement Design for Model Extraction and Validation</i></b> D. Schreurs, K.U.Leuven, Belgium
<b>12:40 - 14:00</b>	<b><i>Lunch</i></b>
<b>14:00 - 15:00</b>	<b><i>Modelling of High-Frequency Phenomena in FET Devices</i></b> T. Martin, Univ. Malaga, Spain
<b>15:00 - 15:40</b>	<b><i>Device Intermodulation Properties and Applications (I)</i></b> A. Mediavilla, Univ. Cantabria, Spain
<b>15:40 - 16:10</b>	<b><i>Coffee Break</i></b>
<b>16:10 - 16:30</b>	<b><i>Device Intermodulation Properties and Applications (II)</i></b>
<b>16:30 - 17:30</b>	<b><i>Nonlinear Microwave Modelling Approaches for GaN and GaAs FETs in the Presence of Low-Frequency Dispersive Effects</i></b> A. Santarelli and F. Filicori, University of Bologna, Italy
<b>17:30 - 17:50</b>	<b><i>Panel Session</i></b>

## FRIDAY WORKSHOPS AND SHORT COURSES



8:45 to 12:40 Room: Livia

### SHFR3 (EuRAD)

#### Understanding High Resolution SAR Images

##### Organisers:

Pierfrancesco Lombardo, 'Sapienza' University of Rome, Italy  
Chris J. Oliver, InfoSAR Ltd, UK

##### Abstract

High Resolution SAR (synthetic aperture radar) images are in the process of being widely available for the applications. Images with resolutions in the range of a few centimetres to 2-3 meters are provided both from the new generation satellite SAR (Cosmo-SkyMed, TerraSAR-X, RadarSat-II) and from the many airborne SAR and UAV SAR under development or already in operation. However, since such high resolution data has not been widely available to the scientific community in the past; only a limited number of research centres/universities has been able to develop the advanced signal processing technique and to extract the information from the high resolution images.

The workshop aims at providing a top-level tutorial review of the developed techniques, together with a clear vision of the requirements (for both military and civilian applications) and an insight into the ongoing research in the field. This includes: high resolution change detection, polarimetry, multi-frequency, bi- and multi-static SAR imaging, SAR constellations, high resolution multi-channel SAR, moving target detection, SAR jamming protection, high resolution SAR interferometry, super-resolution, apodization, etc...

The attendees of the Workshop will have a wide view of the specific characteristics of high resolution SAR images, of the techniques to extract information from them, as well as of the new challenges for the information extraction based on SAR.

##### Programme

8:45 - 9:25

##### **Single Channel SAR GMTI**

C. J. Oliver, InfoSAR Ltd, UK

9:25 - 10:05

##### **Resolution Aspects in SAR Polarimetry**

L. Ferro-Famil, Université de Rennes 1, France  
A. Reigber, DLR, Germany

10:05 - 10:25

##### **Detecting and imaging Targets in Hi-Res SAR and ISAR Images (I)**

P. Lombardo and D. Pastina,  
'Sapienza' University of Rome, Italy

10:25 - 11:00

##### **Coffee Break**

11:00 - 10:20

##### **Detecting and imaging Targets in Hi-Res SAR and ISAR Images (II)**

P. Lombardo, 'Sapienza' University of Rome, Italy

11:20 - 12:00

##### **Airborne SAR Imaging of Vehicle-Sized Target: Circular, Spotlight, Asymmetric Bistatic, Air-to-Air Geometries.**

H. Cantaloube, ONERA, France

12:00 - 12:40

##### **Results and Progresses of Advanced Hybrid Bistatic SAR Experiments**

R. Wang and O. Loffeld, University of Siegen, Germany  
J.H.G. Ender, FGAN, Germany



8:45 to 17:50 Room: Minerva

## WFFR14 (EuRAD/EuMC) Advanced Radar Techniques

### Organiser:

Peter Hoogeboom, Delft University of Technology/TNO Defence, Security and Safety, The Netherlands

### Abstract

Radar systems have evolved from straightforward analog pulse-based devices to systems that have a high degree of digital control and digital signal generation and -processing. Throughout the years the digitization of radar systems has grown. More functions were implemented and A/D and D/A conversion came closer to the RF chain. Currently most radars exploit digital IF sampling rather than video sampling. Digital control is available in beam steering, mode control and pulse commanding. Digital signal generation leads to both very stable and complex transmitted signal patterns. The digital signal processing enables the full exploitation of functions that are provided by the digital modulation. Digital beamforming and the use of sub-arrays enhances the capabilities provided by the beam steering.

In this workshop several advanced techniques will be introduced, i.e. FM-CW Radar, MIMO Radar, Ultra Wide Band Radar, Waveform coding, Synthetic Aperture Radar, Software Defined Passive Radar, Forward Scattering Radar.

These topics are not only stand-alone advanced techniques, but also allow for powerful combinations, like for instance FM-CW (MIMO or Software Defined) SAR. Waveform coding allows for efficient, optimized and advanced data acquisition with radar systems. The discussion at the end of the workshop will enable the exchange of ideas on combined applications, but also to explore under exposed and unclear elements of the contributions during the day.

### Programme

<b>8:45 - 8:55</b>	<b>Introduction</b> P. Hoogeboom, Delft University of Technology, The Netherlands
<b>8:55 - 9:40</b>	<b>Waveform Coding</b> P. van Genderen, Delft University, The Netherlands
<b>9:40 - 10:25</b>	<b>Forward Scattering Radar</b> M. Cherniakov, University of Birmingham, UK
<b>10:25 - 11:00</b>	<b>Coffee Break</b>
<b>11:00 - 11:50</b>	<b>Software Defined Passive Radar</b> H. Kuschel, FGAN, Germany
<b>11:50 - 12:40</b>	<b>MIMO Radar</b> B. Mulgrew, University of Edinburgh, UK
<b>12:40 - 14:00</b>	<b>Lunch</b>
<b>14:00 - 14:50</b>	<b>FM-CW Radar</b> A. Huizing, TNO, The Netherlands
<b>14:50 - 15:40</b>	<b>Synthetic Aperture Radar</b> P. Hoogeboom, TNO/ Delft University, The Netherlands
<b>15:40 - 16:10</b>	<b>Coffee Break</b>
<b>16:10 - 17:00</b>	<b>Ultra Wideband Radar</b> A. Yarovoy, Delft University, The Netherlands
<b>17:00 - 17:50</b>	<b>Discussion</b>



8:45 to 12:45 Room: Niside

## WHFR15 (EuRAD)

### Imaging Radars in Earth Observations: Techniques and Applications

#### Organiser:

Domenico Solimini, University of Rome 'Tor Vergata', Italy

#### Abstract

In the last two decades, several space agencies dedicated resources to observing the Earth from space by Synthetic Aperture Radars. The pioneering SAR missions demonstrated the potential of radar images in providing information for civil applications, including the commercial segment. The steadily growing demand of products and services is impacting the technical specifications of missions and sensors, which are driven by both applications and data exploitation techniques. The applications of imaging radars and the corresponding acquisition and data processing techniques are now a crucial element connecting the manufacturing industry with the scientific and commercial Earth Observation (EO) community.

The workshop aims at bringing together the actors in the EO chain at the various levels, by highlighting some significant fields of common interest and interaction.

The classification, change detection, and moving object identification techniques for SAR images, and in particular for the new metric resolution images, are presented and discussed. Monitoring land displacement is crucial in events related to tectonic and volcanic activity, landslides and subsidence. SAR differential interferometry, is surveyed, technical requirements are discussed and relevant results reported. PolInSAR techniques, are presented, together with a discussion on advantages and limitations of compact polarimetry, which is being considered for future missions. Finally, the incoming ESA SAR missions are illustrated, with reference to Sentinel-1, continuing the C-band observations, and to P-band imaging for global carbon monitoring and subsurface imaging in arid regions.

#### Programme

<b>8:45 - 9:15</b>	<b><i>The Perspectives of Meter-Resolution SAR Applications: Scene Understanding and beyond</i></b> Mihai Datcu, DLR, Germany
<b>9:15 - 9:45</b>	<b><i>Applications of SAR to Recognition of Moving Objects</i></b> Joachim Ender, FGAN, Germany
<b>9:45 - 10:15</b>	<b><i>A Survey of Differential SAR Interferometry for Surface Displacement Monitoring</i></b> Antonio Iodice, Università di Napoli, Federico II, Italy
<b>10:15 - 10:25</b>	<b><i>Discussion</i></b>
<b>10:25 - 11:00</b>	<b><i>Coffee Break</i></b>
<b>11:00 - 11:30</b>	<b><i>Applications of SENTINEL 1 to Earth Observation</i></b> Betlem Rosich, ESA/ESRIN, Italy
<b>11:30 - 12:00</b>	<b><i>Compact and Full Polarimetric SAR Techniques</i></b> Marco Lavelle, University of Rome 'Tor Vergata', Italy
<b>12:00 - 12:30</b>	<b><i>P-Band SAR for Earth Observation</i></b> Thuy Le Toan, CESBIO, France
<b>12:30 - 12:45</b>	<b><i>Discussion</i></b>