Italian National Committee

2020 Italian URSI Annual Meeting

The annual Meeting of the Italian URSI Committee will be held on **November 27, 2020** jointly with the XXIII Riunione Nazionale di Elettromagnetismo (Italian National Meeting on Electromagnetics – RiNEm) (www.elettromagnetismo.it/rinem2020)

Venue: Meeting hosted by the virtual platform *BigBlueButton* managed by GARR consortium, please provide your Google e-mail address through this Doodle page for registration

Date: Friday, November 27, 2020

Organizers: Carlo Carobbi (University of Florence), Giuliano Manara (University of Pisa)

PROGRAMME

The URSI Italian National Meeting is intended to disseminate and promote the activities of the International Radio Science Union, one of the oldest and largest scientific Unions supporting education and research in all Radio Science fields (www.ursi.org). The meeting offers an URSI Special Session with tutorials exemplifying its scientific activities, and the presentations of the three finalists of the 2020 Best Paper Young Scientist Award delivered by the URSI Italian National Committee and named after Prof. Roberto Sorrentino. This year, tutorials will be introduced by a presentation of the winner of the URSI GASS 2020 Student Paper Competition.

12:00 **Carlo Carobbi**
President of URSI Italian Committee
"*The International Union of Radio Science (URSI) and its Italian and International Activities*"

12:20 **"Roberto Sorrentino" Award Session**
Session Chairs: Giuliano Manara, Secretary URSI Italian Committee

12:20 **Introduction to the award session**

12:30 **Presentations of the three finalist papers (15 minutes plus 5 minutes questions each)**

13:30 **Break**

14:15 **URSI Special Session**
Session Chairs: Carlo Carobbi, President URSI Italy

14:15 **Giulia Sacco**
(Winner of the URSI GASS 2020 Student Paper Competition)
"An FMCW Radar for Localization and Vital Signs Measurement for Different Chest Orientations"

14:45 **Giordano Spadacini**
(Commission E: Electromagnetic Noise and Interference)
"The Threat of Radiated Intentional Electromagnetic Interference (IEMI): Deterministic and Statistical Prediction Models for Field Coupling to Cables and Systems"

15:15 **Federica Poli**
(Commission D: Electronics and Photonics)
"Thermal effects on supermodes in Yb-doped multicore fibers for high-power lasers"

15:45 **Lorenzo Figini**
(Commission H: Waves in Plasma)
"RF heating and diagnostic systems in magnetic confinement plasma devices for fusion power"

16:15 **Break**

16:30 **Joint URSI-SIEm Award Ceremony**

17:30 **Closing of the meeting**

SUMMARIES OF THE URSI SPECIAL SESSION PRESENTATIONS

An FMCW Radar for Localization and Vital Signs Measurement for Different Chest Orientations

Giulia Sacco – Università di Roma "La Sapienza"

Abstract: In a realistic configuration for ambient assisted living (AAL) applications it is important to measure the vital signs of a patient continuously and non-invasively. Thanks to the ability to retrieve the respiratory and heart rates remotely, radars represent an optimal solution for this kind of applications. However, during the normal daily activity the thorax orientation towards the antenna is usually unknown and it is necessary to investigate the radar performances in these conditions. In this work a 5.8 GHz frequency-modulated continuous wave (FMCW) radar with ad hoc designed wideband and low side lobe level series fed patch antennas is used to measure vital signs. Measurements were performed in a common office environment on five volunteers having the front, left, back, and right side facing the antenna. The signals collected by the radar were compared with the ones measured by a respiratory belt and a photoplethysmograph, used as references for the respiratory and heart rate, respectively. The data obtained from the 5 subjects were analysed statistically. Results revealed that independently of the orientation the radar was able to measure the respiratory and heart rate with high accuracy.

The threat of radiated Intentional Electromagnetic Interference (IEMI): deterministic and statistical prediction models for field coupling to cables and systems

Giordano Spadacini – Dipartimento di Elettronica, Informazione e Bioingegneria, Politecnico di Milano

Abstract: New technologies are pushing modern society towards an unprecedent dependence upon electronics. In this context, the protection of circuits and systems against Intentional Electromagnetic Interference (IEMI) is gaining increasing interest. According to standard IEC-61000-2-13, IEMI exploits "intentional malicious generation of electromagnetic energy, introducing noise or signals into electric and electronic systems, thus disrupting, confusing or damaging these systems for terrorist or criminal purposes." As a special case, radiated IEMI attacks are based on the generation of electromagnetic fields with E-field peaks exceeding hundreds of V/m, made possible by High-Power Electromagnetic (HPEM) technology. For instance, intentional HPEM fields may encompass both narrowband waveforms having any center frequency in the GHz range, and ultra-wideband waveforms characterized by any spectral content typically above 300 MHz. After a review of the typical electromagnetic environments, this tutorial will tackle the problem of modeling field coupling to cables and systems. Many inherent uncertainties in the problem (like the actual spectral content of the field, the direction of incidence and polarization, etc.) suggest the use of deterministic (e.g., worst-case analysis) and statistical approaches, or a combination of both, for the description of susceptibility effects.

Thermal effects on supermodes in Yb-doped multicore fibers for high-power lasers

Federica Poli – Dipartimento di Ingegneria e Architettura, Università di Parma

Abstract: High-power lasers based on large mode area Yb-doped fibers are becoming more and more important for many applications. The excess heat generated during the amplification process, combined with the thermo-optic effect, is responsible of an unwanted change of the fiber refractive index profile and, consequently, of the higher-order mode propagation in fibers which should operate in single-mode regime. Multicore fibers, with more than one Yb-doped core, represent a possible solution to overcome the fiber laser output power limits caused by the thermo-optic instabilities. In this presentation, the impact of the thermally induced refractive-index change on the supermodes guided in Yb-doped multicore fibers is analyzed through a finite-element-based solver with an embedded thermal model. Useful design guidelines for the choice of core number and core separation in the fiber cross-section will be provided for different heating conditions.

RF heating and diagnostic systems in magnetic confinement plasma devices for fusion power

Lorenzo Figini – Istituto per la Scienza e Tecnologia dei Plasmi, Consiglio Nazionale delle Ricerche

Abstract: High performance scenarios in magnetic confinement plasma devices typically have a core plasma temperature of the order of tens of keV, which is in the range of plasma parameters required for fusion reactions to occur. In tokamaks, ohmic heating alone is not adequate to raise the temperature to sufficiently high values, since plasma resistivity drops as temperature increases. To overcome this limitation, different auxiliary plasma-heating techniques have been developed, based on either the injection of intense beams of neutral particles or the coupling of RF waves resonantly absorbed by the plasma, each method having its own advantages and drawbacks. In this work we will review the distinctive features of the various techniques based on RF waves. A greater focus will be put on Electron Cyclotron (EC) waves, which will play a major role in providing heating power to the next generation of fusion devices. We will discuss the peculiarities that make EC waves attractive not only for heating, but also for the control of magneto-hydrodynamic instabilities, as well as their use as a diagnostic tool. The burning plasma of future fusion reactors will also pose new challenges, demanding innovative designs for their RF-based heating systems.