ELEctromagnetic DIAgnostics Research Center

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SEMINAR:

Metamaterial cloaking: from basic principles to applications in antenna systems

Speakers: **Prof. Filiberto Bilotti, Prof. Alessandro Toscano**
(Università Roma TRE, Roma)

Date: 24 November 2014 @ 04:00 PM

Location: Room OFEK - Polo Scientifico F. Ferrari - Povo

Note: The seminar will be held in English

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The lecture aims at giving the basic principles of cloaking and electromagnetic invisibility. The main differences between cloaking and other common techniques used in microwave and radar technologies and based on radar absorbing materials and structure shaping (i.e. stealth aircrafts) are first remarked and carefully addressed. Then, the main techniques recently presented in the literature to achieve electromagnetic invisibility (transformation electromagnetics, scattering cancellation, transmission-line cloaks, corrugated surfaces, etc.) will be briefly presented. Proper figures of merit to describe the effectiveness of an invisibility cloak will be presented and discussed. A comprehensive comparison among the main cloaking techniques will be presented in order to show what is the best cloaking approach, depending on the application and the requested performances. The scattering cancellation approach to cloaking will be presented with further details and two typical implementations (i.e. plasmonic cloaks and mantle cloaks) will be discussed. Finally, possible applications of the scattering cancellation approach in antenna systems will be presented and discussed with the help of several examples (e.g. cloaking a metallic rod, reducing antenna blockage, cloaking a sensor, cloaking a half-wave dipole, reducing the mutual coupling and the mutual blockage effect between two antennas, etc.)

- ## About the Speakers

Prof. Filiberto Bilotti received the laurea and Ph.D. degrees both in electronic engineering from "Roma Tre" University, Rome, Italy, in 1998 and 2002, respectively. Since 2002, he has been with the Department of Engineering, "Roma Tre" University, where he works as an Associate Professor of electromagnetic field theory. His main research interests are in microwave and optical applications of artificial electromagnetic materials, metamaterials and metasurfaces. He is the author of more than 370 papers in international journals, conference proceedings, and book chapters. Prof. Bilotti served as a member of the Technical Program, Steering, and Organizing Committee of several national and international conferences, as organizer and chairman of special sessions focused on the applications of metamaterials at microwave and optical frequencies, as an Associate Editor of the IEEE TRANSACTIONS ON ANTENNAS AND PROPAGATION (2013–present) and Metamaterials Journal (2007–2013), as a member of the Editorial Board of the journals EPJ Applied Metamaterials (2013–present) International Journal on RF and Microwave Computer-Aided Engineering (2009–present), Scientific Reports – Nature (2013–present), and as a Technical Reviewer of the major international journals related to electromagnetic field theory and metamaterials. He was an elected member of the Board of Directors (2007–2013) and currently is the President (2013–2016) of the Virtual Institute for Artificial Electromagnetic Materials and Metamaterials (METAMORPHOSE VI, the International Metamaterials Society). He is a member of the Optical Society of America. He was the recipient of the Raj Mittra Travel Grant Senior Researcher Award in 2007. From 2004 to 2008, he was a member of the governing bodies of METAMORPHOSE, the European Network of Excellence on Metamaterials. He is a member of the Steering Committee of the European Doctoral School on Metamaterials and the organizer of several international school events and international workshops and conferences in the field of metamaterials. He has been the local organizer of the First International Congress on Advanced Electromagnetic Materials and Metamaterials in Microwaves and Optics-Metamaterials 2007 (Rome, Italy, October 2007), served as the Chairman of the Steering Committee and has been elected General Chair of the same conference for the period 2008–2014 and 2015–2018, respectively.

Prof. Alessandro Toscano was born in Capua, Italy, on June 26th 1964. He received the Laurea and Ph.D. degrees in electronic engineering from "La Sapienza" University, Rome, Italy, in 1988 and 1993, respectively. In January 2012, as the winner of a public contest, he became Full Professor of Electromagnetic Field Theory at the Department of Engineering of "Roma Tre" University where he is now member of the Academic Senate. His research activity is focused on metamaterials and nonconventional media with the ultimate aim to respond to the need to develop new technologies making use of the electromagnetic fields to design new components and to protect the environment and human health. His contributions include: 1) analysis and design of innovative antennas loaded with chiral and bi-anisotropic materials; 2) development of finite element-boundary integral methods to bear concepts in mathematical physics and applied electromagnetics to solve long-standing problems involving nonconventional materials; 3) design of metamaterial inclusions and metamaterial-based components to solve practical problems in electromagnetics. His work to date has resulted in more than 100 journal papers, and more than 200 conference papers. Of these, around 150 have appeared in the IEEE journals and conferences.