ELEctromagnetic DIAgnostics Research Center

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SEMINAR:

RF Tomography, MRI, EMC, and High Frequency Methods

Speaker: **Prof. Danilo Erricolo**
(University of Illinois, Chicago, USA)

Date: 11 September 2013 @ 10:00 AM

Location: Room A105 – Polo Scientifico F. Ferrari - Povo

Note: The seminar will be held in English

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RF tomography combined with the use of ultranarrowband (UNB) signals to detect underground cavities was proposed by Wicks in 2007. A set of transmitters (Txs) and a set of receivers (Rxs) are placed on (or in) the ground at arbitrary positions above the area to be explored. The Txs radiate a monochromatic signal, which impinges upon a buried dielectric or conductive anomaly, thus generating a scattered field. Multiple Rxs collect samples of the scattered electric field and relay this information to a base station. Images of the below-ground scene are then reconstructed using appropriate algorithms to solve an inverse problem. RF tomography makes use of UNB signals, contrary to ground penetrating radar (GPR) that uses ultra-wide band (UWB) signals. One reason for using UNB signals is to reduce spectral occupancy. Another reason is to minimize the cost of sensors. RF tomography is considered for exploring large areas that could not be accessible or dangerous for humans. In such cases, it may still be possible to deploy a large number of sensors over the area of interest, for example by means of an UAV. Hence, because of the potentially large number of sensors to deploy, one seeks a technical solution that minimizes the cost of the sensors and those that operate using UNB signals are less expensive and technologically easier to build than UWB ones. Moreover, operation at a single frequency removes all complications due to the dispersive nature of materials and reduces noise effects. In the mathematical formulation of RF tomography, the propagation of the incident field from the transmitters to the underground objects and the propagation of the scattered field to the surface are accounted for by the forward model. The forward model provides a relationship linking the measured fields to the underground dielectric profile, which is the unknown. This relationship is then inverted to obtain the image of the underground profile.

I will also discuss my activities in the field of magnetic resonance imaging (MRI), electromagnetic compatibility (EMC) and high-frequency methods to study scattering problems.

- **About the Speaker**

Danilo Erricolo received the Laurea degree of Doctor (summa cum laude) in electronics engineering from the Politecnico di Milano, Milano, Italy, in 1993 and the Ph.D. degree in electrical engineering and computer science from the University of Illinois at Chicago (UIC), Chicago, in 1998. He is currently an Associate Professor with theDepartment of Electrical and Computer Engineering, UIC, where he is also the Associate Director of the Andrew Electromagnetics Laboratory.
His research interests are primarily in the areas of wireless communications, electromagnetic scattering, and electromagnetic compatibility. His research activity has been supported by the Department of Defense and the National Science Foundation. He has authored or coauthored more than 170 publications in refereed journals and international conferences. In 2009, he was a U.S. Air Force Summer Faculty Fellow. Dr. Erricolo is a member of Eta Kappa Nu and was elected a full member of the U.S. National Committee of the International Union of Radio Science (USNC-URSI) Commissions B and E. He served for USNC-URSI E as Secretary (2004–2005), Vice-Chair (2006–2008), and Chair (2009–2011); since 2009 he has served as Chair of the USNC-URSI Ernest K. Smith Student Paper Competition, and he was elected Member at Large of USNC-URSI for the triennium 2012-2014. He is an Associate Editor for the IEEE Antennas and Wireless Propagation Letteres. He was the Vice-Chair of the Local Organizing Committee of the XXIX URSI General Assembly (Chicago, IL, USA, August 7–16, 2008) and the General Chair of the 2012 IEEE Antennas and Propagation International Symposium/USNC National Radio Science Meeting (Chicago, IL, USA, July 8–14, 2012). He was elected as member of the Administrative Committee of the IEEE Antennas and Propagation Society for the triennium 2012-2014.