Short Course

Compressive Sensing – Basics, State of the Art, and Advances in Electromagnetic Engineering

presented by ELEDIA Research Center director:

Professor Andrea MASSA

Co-organized by:

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Talk Abstract:

The widely known Shannon/Nyquist theorem relates the number of samples required to reliably retrieve a "signal" to its (spatial and temporal) bandwidth. This fundamental criterion yields to both theoretical and experimental constraints in several Electromagnetic Engineering applications. Indeed, there is a relation between the number of measurements/data (complexity of the acquisition/ processing), the degrees of freedom of the field/signal (temporal/spatial bandwidth), and the retrievable information regarding the phenomena at hand.

The new paradigm of Compressive Sensing (CS) is enabling to completely revisit these concepts by distinguishing the "informative content" of signals from their bandwidth. Indeed, CS theory asserts that one can recover certain signal/phenomena exactly from far fewer measurements than it is indicated by Nyquist sampling rate. To achieve this goal, CS relies on the fact that many natural phenomena are sparse (i.e., they can be represented by few non - zero coefficients in suitable expansion bases), and on the use of aperiodic sampling strategies, which can guarantee, under suitable conditions, a perfect recovery of the information content of the signal.

Despite its recent introduction, the application of CS methodologies Electromagnetics has already enabled several innovative design/synthesis methodologies and retrieval/diagnosis methods to be developed.

In this framework, the short course is aimed at reviewing the fundamentals of the CS paradigm, specifically focusing on the applicability conditions, requirements, and guidelines for EM applications. Moreover, it is aimed at illustrating the state-of-the-art and the most recent advances in Electromagnetic Engineering (including application of CS to antenna synthesis and diagnosis, direction-of-arrival estimation, inverse scattering, and radar imaging), as well as at envisaging possible future research trends and challenges within CS as applied to Electromagnetics.

Biography:

Andrea Massa (*IET Fellow, Electromagnetic Academy Fellow, IEEE Senior Member*) received the “laurea” degree in Electronic Engineering from the University of Genoa, Genoa, Italy, in 1992 and Ph.D. degree in EECS from the same university in 1996. From 1997 to 1999, he was an Assistant Professor of Electromagnetic Fields at the University of Genoa. From 2001 to 2004, he was an Associate Professor at the University of Trento. Since 2005, he has been a Full Professor of Electromagnetic Fields at the University of Trento.

At present, Prof. Massa is the director of the ELEDIA Research Center with a staff of more than 40 researchers located in the network of federated laboratories in Brunei, China, Czech Rep., France, Italy, Japan, Perù, Tunisia. Moreover, he is Adjunct Professor at Penn State University (USA), Professor @ CentraleSupélec, holder of a ‘Senior DIGITEO Chair’ in Paris-Saclay (France), and holder of a ‘Catedra de Excelencia’ at the Universidad Carlos III de Madrid, Madrid (Spain). It has been appointed IEEE AP-S Distinguished Lecturer (2016-2018).

His research activities are mainly concerned with inverse problems, analysis/synthesis of antenna systems and large arrays, radar systems synthesis and signal processing, system-by-design and material by design (metamaterials and reconfigurable materials), and theory/applications of optimization techniques to engineering problems (telecoms., biology, medicine).

Prof. Massa published more than 290 scientific publications on international journals, 400 in international conferences (> 100 invited contributions). He has organized more than 50 scientific sessions in international conferences and he has participated to several technological projects in the European framework (20 EU Projects) as well as at the national level (>100 Projects/Grants).

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Location:

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