

# Short Course

## Compressive Sensing – Theory, Techniques, and Applications to Inverse Scattering

presented by ELEDIA Research Center director:  
**Professor Andrea MASSA**

Co-organized by:



**ELEDIA Research Center**



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### Talk Abstract:

Compressive sensing presents a new way of dealing with information retrieval and signal processing. Instead of the fine sampled version of a signal, computing a full set of transform coefficients (although most of them are negligible), it is possible to directly measure a compressed representation of the signal thanks to the observation that most signals that arise in nature are sparse with relatively few nonzero coefficients.

Compressive sensing exploits this sparsity allowing the information retrieval process (i.e., the reconstruction of the original signal) from far fewer linear measurements than the size of the signal. The task of recovering a sparse signal from relatively few measurements then becomes the problem of finding the sparsest solution of a severely underdetermined linear system of equations. Although NP-hard, it can be solved by means of efficient algorithms in many useful circumstances.

The discovery of the “compressive sensing” paradigm has led to the explosion of research worldwide in applied mathematics, engineering, and computer science since its impact goes far beyond compression and it applies whenever acquiring data is difficult, dangerous, or expensive. Thus, it has been rapidly exploited in several and different ranges of practical electromagnetic problems almost always leading to striking results that significantly advance the state-of-the-art.

The objective of the short-course is therefore to provide the attendees an overview of CS as well as on its applications to electromagnetics and, more specifically, to inverse scattering. More in detail, after reviewing basics and fundamentals of CS, the course will focus on state-of-the-art and mostly recently introduced CS-based techniques and algorithms, discussing capabilities, limitations, and perspectives in Inverse Scattering and Microwave Imaging. Applicative examples including exercises and speeches regarding specific applications will corroborate the developed concepts.

### Biography:


Andrea Massa 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, and holder of a Senior DIGITEO Chair developed in cooperation between the Laboratoire des Signaux et Systèmes in Gif-sur-Yvette and the Department “Imagerie et Simulation for the Contrôle” of CEA LIST in Saclay (France). Prof. Massa serves as Associate Editor of the “IEEE Transaction on Antennas and Propagation”.

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 270 scientific publications on international journals, 350 in international conferences (> 70 invited contributions). He has participated to several technological projects in the European framework (20 EU Projects) as well as at the national level (>100 Projects/Grants).

**Dates:** From Tuesday, February 07, 2017  
To Thursday, February 09, 2017

**Location:**  
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