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"**Interval Analysis – Fundamentals and Electromagnetic Engineering Applications**"

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Abstract

Interval Analysis (IA) consists of a set of rules and tools for the analysis and optimization of functions where the variables at hand are intervals of numbers and not single values as in classical arithmetical/optimization problems. For example, an interval of real values (a real interval) can be defined as a one-dimensional compact set (a segment) between two extreme points, namely the minimum and maximum interval values. Also complex intervals exist and ad-hoc rules are defined within IA for the arithmetical operations between them.

Currently, the use of IA has been limited to some pioneering works in Engineering even though it has several attractive features that can overcome some limitations of current state-of-the-art approaches and theories. Let us consider the following issues:

- IA has an intrinsic capability to deal with uncertainties, always present when experimental measurements are at hand;
- analytical equations and relationships can be easily reformulated and addressed by including intervals of numbers once the fundamentals of IA are known;
- the bounds of a function when evaluated over an interval are determined in a straightforward manner without the need of evaluating the function on all (infinite) points of the interval;
- IA offers ad-hoc global optimization techniques able to identify the global optimum with the desired level of accuracy.

The seminar is aimed to provide an introduction to the fundamentals of Interval Analysis, starting from intuitive explanations to rigorous mathematical and methodological insights. A review of recent applications of IA in Electromagnetics will be illustrated with particular emphasis on inverse scattering problems and antenna array analysis and synthesis.

Paolo Rocca received the MS degree in Telecommunications Engineering from the University of Trento in 2005 (summa cum laude) and the PhD Degree in Information and Communication Technologies from the same University in 2008. He is currently Assistant Professor at the Department of Information Engineering and Computer Science (University of Trento) and a member of the ELEDIA Research Center. Dr. Rocca is the author/co-author of over 230 peer reviewed papers on international journals and conferences. He has been a visiting Ph.D. student at the Pennsylvania State University (U.S.A.), at the University Mediterranea of Reggio Calabria (Italy), and a visiting researcher at the Laboratoire des Signaux et Systèmes (L2S@ Supélec, France) in 2012 and 2013. Moreover, he has been an Invited Associate Professor at the University of Paris Sud (France) in 2015. Dr. Rocca has been awarded from the IEEE Geoscience and Remote Sensing Society and the Italy Section with the best PhD thesis award IEEE-GRS Central Italy Chapter. His main interests are in the framework of antenna array synthesis and design, electromagnetic inverse scattering, and optimization techniques for electromagnetics. He serves as an Associate Editor of the IEEE Antennas and Wireless Propagation Letters.

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