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**SEMINAR**

# On the use of Convex Relaxation for Array Synthesis Problems

**Speaker**: **Dr. Benjamin Fuchs**
*(University of Rennes 1, France)*
**Date**: 28 February 2017 @ 11:30 AM
**Location**: Room A107 – Polo Scientifico F. Ferrari – Povo
**Note**: The seminar will be held in English
**Contact**: Prof. Paolo Rocca (paolo.rocca@unitn.it)

The synthesis of antenna arrays is a very long standing field in electromagnetism because of its many applications (e.g. radar, radio astronomy, sonar, communications, direction-finding, seismology, medical diagnosis and treatment). A host of methods have been proposed since the 40's to solve increasingly difficult synthesis problems. These techniques range from analytical methods (fast but limited to very specific problems) to global optimization approaches (comprehensive but limited in performances due to their computational burden). Convex optimization has been shown to be a good trade-off in efficiency/generality between analytical and global optimization techniques in a number of relevant cases.
The purpose of the talk is to show that a variety of difficult antenna array synthesis problems can be approximated as convex optimization ones and therefore be efficiently solved. More specifically, the application of the semidefinite relaxation technique to approximate the quadratic constraints arising in many synthesis problems is described. The synthesis of shaped beams, phase-only excitations or reconfigurable arrays are instances shown to highlight the practical relevance of the proposed strategy.
In addition, the combinatorial problem of selecting antennas from among a set of possible radiators in order to optimize the performances of the array is addressed. A convex relaxation of the Boolean constraints followed by a probabilistic interpretation of the solution enables to quickly obtain bounds on the best achievable array performances and to make a good antenna selection. Numerical representative examples, such as the selection of quantized array excitations, antenna types and antenna's locations to optimize the array performances are shown to illustrate the interest of the proposed approach.

- **About the Speaker**

**Benjamin Fuchs** received the M.Sc. and electrical engineering degrees in 2004 from the National Institute of Applied Science of Rennes, France, and the Ph.D. degree in signal processing and telecommunications and the "Habilitation à Diriger des Recherches" from the University of Rennes 1, France, in 2007 and 2016, respectively. He was during his Ph.D. a visiting scholar at the University of Colorado at Boulder, USA.
In 2009, he joined the Institute of Electronics and Telecommunications of Rennes (IETR) as a researcher at the Centre National de la Recherche Scientifique (CNRS). He has spent three years (2008 as postdoctoral research fellow and 2011-2012 on leave from CNRS) at the Swiss Federal Institute of Technology of Lausanne (EPFL), Switzerland.
His current research interests revolve around synthesis and inverse problems in electromagnetics for antenna design and microwave imaging. More specifically, he is working on array synthesis, antenna diagnostic, electromagnetic field interpolation and phase retrieval.