University of Illinois at Chicago, Electrical and Computer Engineering Department
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Convex Optimization for Optimal Design and Analysis of Small Antennas

Mats Gustafsson

IEEE Distinguished Antennas and Propagation Lecturer
Professor, Department of Electrical and Information Technology
Lund University, Lund, Sweden

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University of Illinois at Chicago
Department of Electrical and Computer Engineering
Lecture Center F4 (just west of Daley Library)
807 South Morgan Street
Chicago, IL 60607

Host: Prof. Danilo Erricolo, derric1@uic.edu

Abstract

Design of small antennas is challenging as the Q-factor, efficiency, and radiation resistance must be controlled simultaneously. In this presentation, convex optimization together with integral expressions of the stored electromagnetic energies are used to analyze many fundamental antenna problems. The solutions to the convex optimization problems determine optimal currents, offer insight for antenna design, and present performance bounds for antennas. We present several optimization formulations such as maximal gain Q-factor quotient, minimal Q for superdirectivity, minimal Q for given far field, and efficiency. The effects of antennas embedded in structures such as mobile phones are discussed. Results are shown for various antenna geometries and compared to state of the art designs showing that many antennas perform almost optimally. A tutorial description of a method of moment implementation together with a Matlab package for convex optimization to determine optimal current distributions on arbitrarily shaped antennas is also presented.

Biography

Mats Gustafsson received the M.Sc. degree in Engineering Physics 1994, the Ph.D. degree in Electromagnetic Theory 2000, was appointed Docent 2005, and Professor of Electromagnetic Theory 2011, all from Lund University, Sweden. He co-founded the company Phase holographic imaging AB in 2004. His research interests are in scattering and antenna theory and inverse scattering and imaging with applications in microwave tomography and digital holography. He has written over 65 peer reviewed journal papers and over 85 conference papers. Prof. Gustafsson received the Best Antenna Poster Prize at EuCAP 2007, the IEEE Schelkunoff Transactions Prize Paper Award 2010, and the Best Antenna Theory Paper Award at EuCAP 2013. He serves as an IEEE AP-S Distinguished Lecturer for 2013-15.

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