Seminar on

Design of Antennas Through Optimization of Geometry

by

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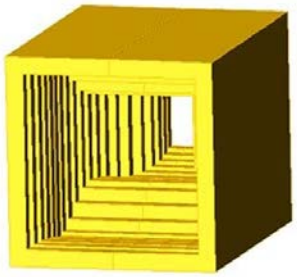
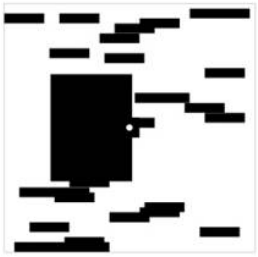
Abstract

Increased flexibility in design of antennas such as cylindrical horns and planar microstrip antennas is possible by allowing the layout in the selected geometry to be chosen as part of meeting the performance objectives. An example is the design of the profiles of electromagnetic horns and dielectric rod antennas [1]. Starting from an initial cross-section geometry the horn profiles are chosen so that desired performance objectives are ultimately achieved. The profiles are obtained by means of standard optimization methods with constraints in order to satisfy the design specifications. Implicit in this is the availability of accurate and fast method for analysing the basic horn structure. These can range from standard computer packages to dedicated packages that are often faster and more accurate. A further example of the approach is the design of planar microstrip patch antennas for a desired bandwidth and radiation performance [2]. The initial antenna is chosen as the driven element and small patches are introduced as part of the optimization process. These patches can be parasitically excited or directly linked to the feed through a power divider.

In this talk the type of geometric constraints are discussed and some optimization methods are compared for handling problems that involve the variation of the geometry, and also bounds that may be required to eliminate overlap and abrupt changes in geometry. Most conventional numerical optimization methods can be used for the design. These range from evolutionary methods such as the Genetic Algorithm, and swarm methods such as the Particle Swarm Optimization. These mentioned techniques are especially valuable in a wide domain search as they balance the fittest location uncovered by an element against others uncovered by neighbours, all of which are subject to constraints. Conventional gradient methods, such as steepest descent, can be advantageous in reaching an optimum solution in fewer function evaluations though once a broad coverage technique has reached a sub-optimum solution. The paper will review some techniques that have been employed to design a range of antennas by optimization of geometry.



Profiled rectangular horn



Particle swarm antenna.

[1] T.S. Bird & C. Granet, "Profiled horns and feeds", in L. Shafai, S.K. Sharma & S. Rao (eds.) "Vol. II: Feed systems" of "Handbook of reflector antennas", Artech House, USA, Chap. 5, 2013.

[2] A. Minasian & T.S. Bird, "Particle swarm antennas for wireless communication systems", EuCAP'11, Rome, 11 - 15 April 2011, pp. 897-899.

Biography

Trevor Bird graduated with a PhD from the University of Melbourne in 1977. Afterwards he worked in the UK and returned to Australia to lecture at James Cook University of North Queensland before joining CSIRO in 1983. He held several senior positions in CSIRO and was Chief Scientist of the CSIRO ICT Centre from 2004 to 2011.Currently he is Principal of Antengenuity a specialised consultancy firm, an Adjunct Professor at Macquarie University, and a CSIRO Honorary Fellow.

He has published over 300 papers, 1 book, 10 book chapters, and he holds 12 patents. He is a Fellow of four learned societies, including IEEE, is an Honorary Fellow of the Institution of Engineers, Australia, and is a Fellow of the Australian Academy of Technological Sciences and Engineering.

Dr Bird has been awarded three CSIRO Medals, an IEEE Third Millennium Medal, a Centenary Medal for service to Australian society in telecommunications, five best paper awards, was named 2003 Professional Engineer of the Year by the Sydney Division of Engineers Australia and in 2012 he received the M.A. Sargeant Medal for 2012 from Engineers Australia for achievement in the field of electrical engineering.

He was made a CSIRO Fellow in 2007 and in 2010 he completed six years as Editor-in-Chief of the IEEE Transactions on Antennas & Propagation. In 2013 he was President of the IEEE Antennas & Propagation Society.

Date : **15 September 2015 (Tuesday)**
Time : **04:30 pm – 05:30 pm**
Venue : **Room 15-202, 15/F, meeting room of State Key Laboratory of Millimeter Waves, 15/F, Academic 3, City University of Hong Kong**

***** ALL ARE WELCOME *****

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