IEEE AP-S / MTT-S Joint Chapter Victoria

IEEE AP Distinguished Lecture Seminar

Lens antennas: Fundamentals and present applications

Presenter: Professor Oscar Quevedo-Teruel
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Time: 5:30 pm refreshments for 6:00 to 7:00 pm talk,
Monday, 24th June 2019

Venue: RMIT University, Building 80, Level 7, Room 9
435-457 Swanston Street, Melbourne.

RSVP: For catering purposes please register at Eventbrite
(free event and guests welcome)

Abstract:

Lens antennas are commonly englobed in a more general type of antennas, named aperture antennas. As their name indicates, they make use of a lens to modify the field distribution at the aperture of the antenna, which is typically fed by a single source. The lens is employed to transform the waves arriving from the source into a desired radiation pattern. Commonly, the desired radiation pattern is a directive beam in a given direction. However, similar to arrays, reflectors or leaky wave antennas, the goal changes depending on the application. For example, other desired features may be to produce multiple beams, or a broad beam-width.

Lenses were more commonly employed in optical applications. For this reason, most of the nomenclature comes from optics, and they are evaluated with rays theory. In this sense, the performance of the lens is conventionally described in terms of aberrations. An aberration is a failure of the rays to converge at the desired focus. This failure must be due to a defect or an improper design. Aberrations are classified as chromatic or monochromatic, depending on whether or not they have a frequency dependence. There are five monochromatic aberrations: spherical aberration, coma, astigmatism, Petzval field curvature, and distortion. However, this is not a common nomenclature for antenna designers in the radio-frequency and microwave regimes. In these regimes, the rays are substituted by electromagnetic fields, and the designers evaluate their antennas in terms of directivity, gain, efficiency, side lobe levels, cross polarization levels, etc. Therefore, there is a communication gap between both communities: optics and microwaves. In the THz regime, which is in between these two communities, researchers must understand both nomenclatures

In this talk, I will explain the operation of lens antennas, their potential, and two innovative techniques that have become very important in recent years. The first technique is transformation optics, which can be employed to produce three-dimensional directive lenses. The second one is metasurfaces, which can be used to produce low-cost and planar two-dimensional lenses. In the case of metasurfaces, fully metallic solutions are possible, which is a clear advantage in terms of losses. However, with the

available technology, metasurfaces are only able to scan in one single plane. Finally, we introduce the concept of higher symmetries, that can be employed to enhance the bandwidth of conventional metasurfaces, or to increase their equivalent refractive indexes.

Biography:

Associate Professor Quevedo-Teruel is a Senior Member of the IEEE. He received his degree in Telecommunication Engineering from Carlos III University of Madrid Spain in 2005; part of which was done at Chalmers University of Technology in Gothenburg, Sweden. He obtained his PhD from Carlos III University of Madrid in 2010 and was then invited as a postdoctoral researcher at the University of Delft, The Netherlands. From 2010-2011, Dr. Quevedo-Teruel joined the Department of Theoretical Physics of Condensed Matter at Universidad Autonoma de Madrid as a research fellow, and went on to continue his postdoctoral research at Queen Mary University of London from 2011-2013. In 2014, he joined the Electromagnetic Engineering Division, in the School of Electrical Engineering and Computer Science at KTH Royal Institute of Technology in Stockholm, Sweden where he is an Associate Professor and director of the Master Programme in Electromagnetics Fusion and Space Engineering. He is an Associate Editor of the IEEE Transactions on Antennas and Propagation since 2018, and he is the delegate of EurAAP for Sweden, Norway and Iceland for the period 2018-2020.

He was the recipient of the Award of Excellence in 2010 from Carlos III University of Madrid. In 2010, he also received the National Award of Arquimedes for the best supervisory of a student project in Engineering and Architecture throughout Spain. He has made scientific contributions to higher symmetries (glide and twist), transformation optics, lens antennas, metasurfaces, leaky wave antennas, multi-mode microstrip patch antennas and high impedance surfaces. He is the co-author of more than 60 papers in international journals, more than 120 at international conferences and has received approval on 2 patents.

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