SPEAKER:

Oscar Quevedo-Teruel is a Senior Member of the IEEE. He received his Telecommunication Engineering Degree 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 Ph.D. from Carlos III University of Madrid in 2010 and was then invited as a postdoctoral researcher to 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 Division for Electromagnetic Engineering in the School of Electrical Engineering and Computer Science at KTH Royal Institute of Technology in Stockholm, Sweden where he is a Full Professor and Director of the Master Programme in Electromagnetics Fusion and Space Engineering. He has been an Associate Editor of the IEEE Transactions on Antennas and Propagation since 2018, a member of the Editoral Board of Nature Scientific Reports since 2021, and the founder and editor-in-chief of the EurAAP journal Reviews of Electromagnetics since 2020. He was the EurAAP delegate for Sweden, Norway, and Iceland from 2018-2020, and he has been a member of the EurAAP Board of Directors since January 2021. He is a distinguished lecturer of the IEEE Antennas and Propagation Society for the period of 2019-2022, and Chair of the IEEE APS Educational Initiatives Programme since 2020.

He has made scientific contributions to higher symmetries, transformation optics, lens antennas, metasurfaces, leaky wave antennas and high impedance surfaces. He is the co-author of 105 papers in international journals and 160 at international conferences.

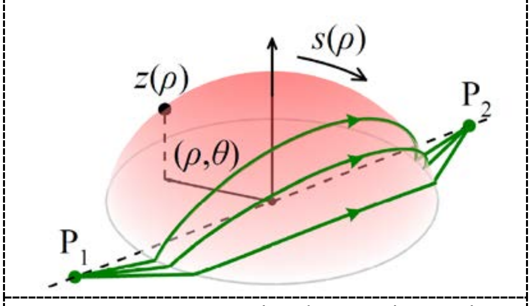
TALK 1: ***Universidad de Málaga – October 20th, 2021 – 12:00h***

Title: Geodesic Lens Antennas for 5G/6G and Satellite Communications

Link: Conference

Abstract:

In this talk, Oscar Quevedo-Teruel will introduce the theory and operation of geodesic lenses. These lenses have attracted the attention of the antenna community due to two of their advantageous properties: low cost and high efficiency. Geodesic lenses make use of a physical path that mimics an equivalent graded refractive index. Therefore, differently to conventional lenses, they can be implemented in a fully-metallic configuration using parallel plate waveguides. This makes these lenses ideal for high-frequency applications, where dielectric materials have prohibitive losses. Moreover, since geodesic lenses can mimic the properties of graded-index lenses, they can provide wide-angle scanning capabilities with reduced scan losses. Therefore, these lenses are an excellent candidate for new applications in the millimeter frequency regime. For example, they are being considered for antenna solutions in 5G/6G, satellite communications in Low-Earth Orbit constellations and automotive radars.



Rays in a generalized Luneburg lens implemented with a geodesic shape

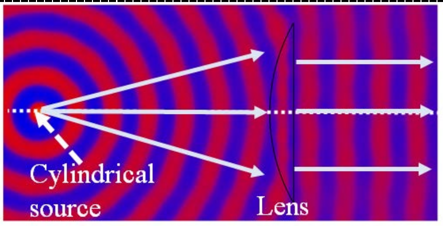
TALK 2: ***Universidad de Granada – October 21th, 2021 – 12:00h***

Title: Lens antennas: Fundamentals and present applications.

Link: Conference

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.



Transformation of a cylindrical wave into a plane wave by using a convex lens represented with rays and waves.

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.

TALK 3: ***Universidad de Sevilla – October 22th, 2021 – 12:00h***

Title: Glide symmetries: a new degree of freedom for the design of periodic structures

Link: Conference

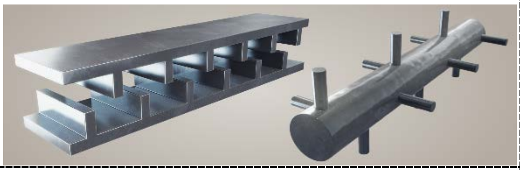
Abstract:

Glide symmetries were employed for electromagnetic purposes during the 60s and 70s. Those works were focused on one-dimensional structures with potential application in low-dispersive leaky wave antennas. However, the development of planar/printed technologies in the 80s and 90s associated to their low-cost for low-frequency applications, the studies of glide symmetries stopped.

In the beginning of the 21st century, with arrival of metamaterials, there was a significant development of the understanding of periodic structures, and new methods of analysis were introduced. This theoretical development, together with the interest of industry in mm-waves, particularly for communications systems such as 5G, created an opportunity to explore the possibilities of glide symmetries, especially in two-dimensional configurations.

Glide-symmetric structures has recently attracted the attention of researchers due to their attractive properties for practical applications. Among their interesting properties are low-dispersive responses in fully metallic structures such as parallel plate or co-planar waveguides (CPW), bandgaps associated to the symmetries and large electromagnetic bandgaps (EBGs).

In this talk, Dr. Quevedo-Teruel will describe the most significant works in glide symmetries, including their application for the design of gap-waveguide technology and planar lens antennas with steerable angles of radiation.



1D glide- (left) and twist- (right) symmetric geometries.