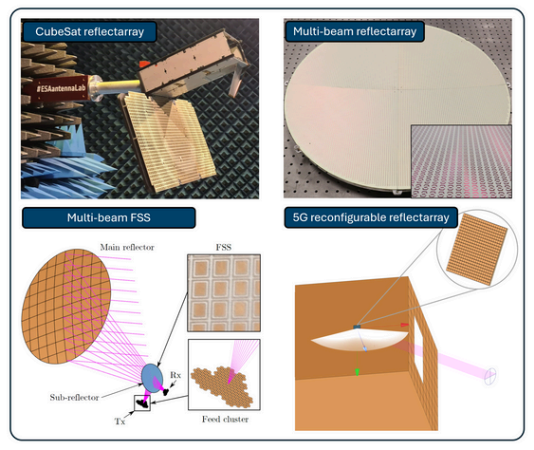
SC02- Design of Quasi-Periodic Surfaces for High-Performance Applications



Abstract

Periodic and quasi-periodic surfaces such as reflectarrays, transmitarrays and frequency- and polarization-selective surfaces are used in applications requiring high data rates, for ground and space applications. By manipulating electromagnetic waves these surfaces can achieve high gain, beam shaping, beam scanning, and multi-beam characteristics. Recently, the possibility of reconfiguring the surfaces with active lumped components or by mechanically rotating the surfaces make them essential in 5G/6G applications, where these are typically called reconfigurable intelligent surface (RIS).

The course aims at providing an introduction to the design of quasi-periodic surfaces and makes use of the freely available TICRA Tools Student Edition. Advanced application cases will finally be shown.

Recommended prerequisites

The course is a tutorial and is primarily designed for participants who have general knowledge of antennas and electromagnetic theory and/or previous experience of quasi-periodic surface design with general purpose commercial software.

Learning objectives

- Identify different types of periodic and quasi-periodic surfaces and have basic knowledge of their design principles and application areas
- Understand the methods that are used to design and analyze periodic and quasi-periodic surfaces
- Make unit cell element design considerations based on the target application and design requirements
- Make antenna system design considerations of periodic and quasi-periodic surfaces
- Use the TICRA Tools Student Edition for designing periodic and quasi-periodic surfaces
- Build on this knowledge to design periodic and quasi-periodic surfaces with specific performance requirements in a wide range of applications from space communication to 5G/6G communication systems

The participants will be provided with presentation slides from the course, as well as a detailed step-by-step solution to the hands-on exercise worked on during the course.

Course outline

This short course provides an overview of how to design periodic and quasi-periodic surfaces such as reflectarrays, transmitarrays and polarization selective surfaces.

- Introduction to periodic and quasi-periodic surfaces
- Analysis and design of periodic unit cell elements
- Analysis and design of finite-sized quasi-periodic surfaces and antenna systems
- Introduction to the TICRA Tools Student Edition
- Hands-on exercise: designing a reflectarray antenna in TICRA Tools Student Edition
- Advanced application cases: utilizing quasi-periodic surfaces in high-performance antenna systems, including live demonstrations

Participants are requested to bring their own laptop and to install the TICRA Tools Student Edition, available for Windows, Linux and macOS.

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Andreas Ericsson received the M.Sc. degree in engineering physics and the Ph.D. degree in electrical engineering from Lund University, Lund, Sweden, in 2013 and 2017, respectively. He joined TICRA in Denmark in 2018 where he is currently working as Senior Research Engineer and Product Lead for the software products QUPES, UQ, SNIFT and DIATOOL. His research interests include design and analysis of quasi-periodic surfaces such as frequency selective surfaces and reflectarrays, analysis of reflector antennas, and antenna measurement techniques. Dr. Ericsson was the recipient of a Student Paper Award at URSI GASS 2014 in Beijing.

Since 2019, Dr. Ericsson has been giving training courses in TICRA's software products, both on basic and advanced level.

Mark Whale received his Ph.D. degree in Experimental Physics from the National University of Maynooth, Ireland in 2010. He subsequently worked in postdoctoral research projects at University of Bern, Switzerland and Chalmers University of Technology, Gothenburg, Sweden, focussing on quasioptical systems for astronomical and atmospheric observation projects. Following this spent eight years with Ericsson AB, working on verification and systems design for mmW phased array antennas for 5G. He joined TICRA in 2022 where he works as a Research Engineer in the Applied Electromagnetics Team. His research interests include design and verification of quasioptical reflector systems and phased array antennas.

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