Coordinator	TICRA  H.H. Viskum (TICRA (ID 4))	
Involved institutions	CHALMERS; IETR Institut d'Électronique et de Télécommunications de Rennes; Università degli Studi di Siena	
Name of the course	**Design and analysis of large reflector antennas and lens antennas**	Type: M ; D ; A/D ■ ; A
Place	Danish Technical University, DK-2800 Lyngby, Denmark	Date: 9-13 May 2005

Summary

Viskum (6 hours)
1) Brief introduction to the analysis methods for spacecraft- and earth station antennas. PO, PTD, GO, GTD. Definition of directivity, polarisation.
2) Radiation from simple apertures, relationship between size, illumination function, directivity and beamwidth.
3) Cross-polarisation in offset antennas, design of polarisation sensitive reflectors.
4) The dual reflector antenna. Blockage analysis of symmetric designs; compensated offset systems
5) Strut scattering effects
Busk Sørensen (4 hours)
6) Design of shaped reflectors for contoured beams
7) Design of beam waveguide feeding systems for large telescopes. First-order Gaussian- beam analysis. Higher-order Gaussian-beam analysis. Auxiliary plane PO.
8) The effect of panel imperfections in large telescopes.
Kildal (4 hours):
9) Design and analysis of the tri-reflector radio telescope in Arecibo and other special reflector antennas. The work include synthesis of the two Arecibo subreflectors and analysis by ray tracing and PO. The presentation will also describe the development of a decade bandwidth feed for the US SKA proposal. SKA is planned international radio telescope of one Square Kilometer Aperture area and more than a decade bandwidth. The US proposal is to build 5000 reflector antennas of 16 m diameter.
Sauleau (3 hours):
10) Basic theory of dielectric lens antennas (design principles, analytical lenses, aberrations, wide angle lenses, taper control lenses, zoning, inhomogeneous lenses).
11) State of the art of current research activities (shaped lens antennas and substrate lenses, reduced-size structures) and main applications (WLAN, high data-rate communications, mm-wave radar and imaging, LEO satellites, High-altitude plateforms, 4th generation of Mobile Broadband Systems, multi-beam antennas, ...).
12) Analysis, Synthesis, Optimization and Performance of shaped substrate lenses. Both BoR and 3D arbitrarily-shaped devices are considered. Analysis: asymptotic methods and global EM modelling. Synthesis: analytical and numerical GO-based solutions for the inverse design problem. Optimization: local (CGM) and global (GA) procedures. Performance: input impedance and radiation characteristics. This part is illustrated by many numerical and perimental results at mm-wave frequencies. Moreover, time-domain simulations will be used for educational purposes.
13) Future trends (bandwidth enhancement, size reduction, non-homogeneous metamaterials-based lenses, ...).
Maci (3 hours)
15) High-frequency methods applied to large reflector antenna problems: the UTD and ITD issues
16) The shadow boundary integral technique. A) reduction from surface to line integral for canonical reflectors.
B acceleration of PO via faceting. ITD corrections
17) Representation by NURBS of reflector surface
18) Diffraction effects in lens antennas: PO correction by using local Sommerfeld proiblem
19) Influence of a dielectric lens on mutual coupling: internal reflection
Computer exercises (12 hours)
The students will be given an opportunity of using state-of-the-art software during exercises to design and analyse reflector antenna systems.

Structure of the course

Lectures	Exp. lab	Computer exercise	Total	Credits	Assessment typology
20 Hours		12 hours	32 hours	2	Attendance: 1 cr Assignements: 1 cr

Teachers

Name	Organization	Title
Hans-Henrik Viskum	TICRA	PhD
Stig Busk Sorensen	TICRA	PhD
P-S Kildal	CHALMERS	Prof.
S. Maci	UNISI	Prof.
R. Sauleau	IETR	Ass. Prof.

Availability of dedicated structures

College rooms		Dedicated Labs		Classrooms		Computer rooms		Canteen	
yes	Not	yes	Not	yes	not	yes	not	yes	Not
	■		■	■		■			■