

Postgraduate Course Advanced Topics on Antenna Technologies (MSc)

Instructor Information

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Course Information

Course Description

This course presents advanced concepts in antenna topics. The students will acquire the required knowledge for the analysis and design of antennas using in-house software and commercial software. The contents of the course will include the main parts of the antenna design topics using a Project Based Learning methodology with the support of the teachers. The students will use the software packages available at the SSR Department of the E.T.S.I. Telecomunicación. The students will handle the design of different types of antennas, since the technology covers much of the advanced topics in antenna area. Examples and applications will be presented as well as related commercial software and MATLAB homework assignments.

Prerequisites

Electromagnetic field Theory

Strong knowledge in basic antenna parameters

In addition, a working knowledge of MATLAB is required

Course Goal

To understand the concepts of the antenna analysis and design and afford all the stages of the design of a specific antenna (antenna project).

Summary of intended course outcomes

The students should be able to understand the concept of the antenna analysis and design. The students will be able to afford all the stages of the design of one specific antenna (antenna project). They will be able to define the most appropriate kind of antenna depending of the required application. By the end of the course, students should be able to:

- Have an overview on Advanced Topics on Antenna Technologies
- Specify, analyse, design and simulate the most suitable antenna for the required application.
- Be familiar with different software with different practical applications of antennas

Syllabus

Advanced Topics on Antenna Technologies (60h)

1. Introduction (4h)

Review/Summary of basic antenna parameters.
Definition of specification/requirements of antenna parameters for each topics.
Purpose and scope of application.
Introduction to commercial software CST Studio.

2. Printed Multiband Antennas (8h)

Overview of multiband antennas.
Frequency reconfigurable printed antennas.
Wideband and multiband antennas.
Analysis and design methods.
Application example: Design of printed antennas.

3. New Trends in Aperture Antennas (8h)

Dual frequency reflector antennas.
Antenna feeders.
Analysis and design methods.
Application example: Design of aperture antennas and antenna feeders.

4. Planar and Conformal Array Antennas (8h)

Planar array antennas.

Optimization and synthesis techniques.

Conformal array antennas.

Analysis and design methods.

Application example: Design of planar and conformal antennas.

5. Smart Antennas (4h)

Active array antennas.

Phased array antennas.

Adaptive array antennas.

Analysis and design methods.

Application example: Design of phased array antennas.

6. Reflectarray and Transmitarray Antennas (8h)

Overview of reflectarray and transmitarray antennas.

Analysis and design of transmitarray antennas.

Analysis and design of reflectarray cells and reflectarray antenna.

Technique for bandwidth improvement.

Contoured-beam reflectarrays.

Dual-reflector configurations.

Reconfigurable and beam-scanning reflectarrays.

Application: Automotive radar, base station antennas, sub-mm waves, space antennas.

Application example: Practical design of reflectarray antennas.

7. Near Field Measurement Techniques (8h)

Antennas measurement systems.

Far-field measurements and compact antenna test range.

Near-field measurements.

Source reconstruction and post-processing techniques

8. Final presentation of the antenna project (12h)

Software material:

- CST Studio Suite (CST Microwave Studio, CST Design Studio)
- Antenna Magus
- FEKO
- GRASP
- SABOR
- MICIAN
- Champ
- Matlab
- MRADANT-UPM (Multilayer Reflect-Array: Design and ANalysis Tool From UPM)
- Reflectarray Antenna Design Manager

Recommended reading material:

- "Antenas" Ángel Cardama, Lluís Jofre, Juan Manuel Rius, Jordi Romeu, Sebastián Blanch Edicions UPC 1993, 1998 y 2002.
- "Antennas. For All Applications". J. D. Kraus. R. J. Marhefka. McGraw Hill. 3rd edition. 2002.
- "Antenna Theory. Analysis and Design" Constatine Balanis John Wiley & Sons 1997.
- "Antenna Theory and Design". W.L. Stutzman Wiley. 1981 y 2001.
- "Antennas and Radiowave Propagation". Robert E. Collin Mc Graw-Hill. 1985.
- "Phased Array Antenna Handbook", R.A. Mailloux, Artech House, 2005.
- "Phased Array Antennas", R.C. Hansen, 2009.
- J. Huang and J. A. Encinar, *Reflectarray antennas*. Piscataway, NJ/New York: IEEE Press/Wiley, 2008.

Student Assessment Criteria

Design laboratory report	30%
1º and 2º phase report project	20%
Final report and oral presentation	40%
Skill assessment (computer simulations)	10%