COMMUNICATION ENGINEERING AND ELECTRONIC TECHNOLOGIES

(Lecce - Università degli Studi)

Insegnamento CAD AND LABORATORY OF HIGH FREQUENCY CIRCUITS AND ANTENNAS

GenCod A005492

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Insegnamento CAD AND LABORATORY OF HIGH FREQUENCY CIRCUITS AND

Insegnamento in inglese CAD AND LABORATORY OF HIGH FREQUENCY

Settore disciplinare ING-INF/02

Corso di studi di riferimento COMMUNICATION ENGINEERING AND

Tipo corso di studi Laurea Magistrale

Crediti 12.0

Ripartizione oraria Ore Attività frontale: 108.0

Per immatricolati nel 2019/2020

Erogato nel 2020/2021

Anno di corso 2

Lingua ITALIANO

Percorso PERCORSO COMUNE

Sede Lecce

Periodo Primo Semestre

Tipo esame Orale

Valutazione Voto Finale

Orario dell'insegnamento https://easyroom.unisalento.it/Orario

BREVE DESCRIZIONE DEL CORSO

The goal of this course is to provide the basic knoweledge of the main numerical techniques and software tools for the Computer Aided Design (CAD) of microwave circuits and antennas. Through problem-solving and design activities, the course will introduce students to conventional passive microwave devices and antennas, as well as to cutting-edge electromagnetic technologies such as wireless power transfer, energy harvesting and metamaterials.

PREREQUISITI

microwaves, electromagnetic field theory

OBIETTIVI FORMATIVI

Knowledge and understanding. During the course the students will acquire the ability to face and solve a generic problem of electromagnetism (design of microwave antennas / components, problems concerning human-antenna interaction, propagation in artificial media, etc.) using commercial or proprietary CAD tools.
In particular, the main learning outcomes are:
* knowledge of the major issues and possible technological solutions related to the design of microwave components and antennas,
* knowledge of the main numerical methods for electromagnetic problems,
* basic knowledge of common commercial software for circuital and full-wave electromagnetic simulations,
* laboratory experiments relative to at least one cutting-edge electromagnetic technology.
Applying knowledge and understanding. After the course the student should be able to:
*select the most suitable numerical method for solving a specific electromagnetic problem,
* use at least two commercial instruments (at least one simulator for the analysis of lumped elements circuits and one for full-wave simulations) for solving electromagnetism problems,
* apply the theoretical knowledge acquired during the course to the resolution of a real problem such as, for example, the design of an antenna or a microwave device that satisfies specific requirements.

Autonomy of judgment. Students are guided to critically learn everything that is explained to them in class, to compare the different methods for analyzing electromagnetic problems and the different design strategies of microwave devices and antennas. The goal is to ensure that at the end of the course students are able to identify and propose, in an autonomous way, the most efficient solution for solving an electromagnetism problem.

Communication skills. It is essential that students are able to communicate with a diverse and composite audience, not culturally homogeneous, in a clear, logical and effective way, using the acquired methodological tools and their scientific knowledge.
In this regard, the course promotes the development of the following skills of the student: ability to expose in precise and formal terms the salient characteristics of a problem of electromagnetism; ability to describe and analyze an efficient solution for the problem under consideration.
Learning ability. Students must acquire the ability to deal with originality and autonomy, with the typical problems of the analysis and design of components and microwave antennas and in general of complex electromagnetic conditions. They must be able to re-elaborate and autonomously apply the knowledge and methods learned in view of a possible continuation of studies at a higher level (doctorate) or in the broader perspective of cultural and professional self-updating of lifelong learning.

METODI DIDATTICI

The course consists of lectures, some of which make use of slides made available to students, laboratory lessons and the development of a project. The lectures are intended to deepen the theory of propagation in cylindrical structures and to expose the theory of the main numerical methods for the analysis of electromagnetic problems. The laboratory lessons are aimed at introducing students to the use of the main commercial software for the analysis and design of microwave circuits. Finally, the project aims to assess students' ability to face and solve a real problem.

MODALITA' D'ESAME	Oral exam and development of a project concerning the design and/or the realization of a microwave device. The objective of the oral exam is to verify the knowledge of the theory underlying: - the analysis of real cylindrical structures, - the main numerical methods for electromagnetism problems, - microstrip planar antennas, - the emerging technologies presented during the course The objective of the project is to verify the student's ability to apply the theoretical skills acquired during the course to the solution of real problems.
PROGRAMMA ESTESO	*Introduction* Introduction to numerical methods for electromagnetics, the computer aided design of microwave devices. (6 hours) *Cylindrical structures* Classification, propagation in open cylindrical structures, resolution methods for cylindrical structures with real conductors. (8 hours) *Numerical methods for electromagnetic problems* The Finite Difference Time Domain (FDTD) numerical method; the Method of the Moments (MoM); the Mode-Matching. (15 hours) *Software tools for microwave circuit design* Commercial software tools for the design and optimization of microwave devices and antennas: introduction and classification of the most widely used commercial software (full-wave simulators and circuital simulators). (6 hours) *Antennas* Theory and applications of planar antennas. (6 hours) *Microwave devices* Microwave resonators, dividers and couplers (3 hours) *Emerging technologies and design strategies for microwave circuits and antennas* Devices for energy harvesting and wireless power transfer; metamaterials; nanomaterials; design and realization of microwave devices on non conventional materials. (18 hours) *Laboratory* Design techniques for microwave passive devices (filters, resonators, couplers, antennas, etc.). Scattering parameters measurements. Computer aided design of microwave devices and antennas: introduction to the use of some of the most widely adopted commercial software (CST Microwave Studio, AWR, etc.). (30 hours) *Project* How to solve a real problem. (16 hours)
TESTI DI RIFERIMENTO	[1] R. Collin, *Foundations for Microwave Engineering*, Mc Graw-Hill. [2] Conciauro, Guglielmi, Sorrentino, *Advanced Modal Analysis*, Wiley. [3] Peterson, Ray, Mittra, *Computational Methods for Electromagnetics*, IEEE Press. [4] A. Paraboni, *Antenne*, Mc Graw-Hill, 1999. [5] Johnson I. Agbinya, *Wireless Power Transfer, 2nd edition*. [6] Alessandro Lipparini, Vittorio Rizzoli, *Propagazione elettromagnetica guidata: parte prima*. [7] Girish Kumar, K.P. Ray, *Broadband Microstrip Antennas*, ISBN-13: 978-1580532440. [8] Handouts provided by the teacher