

Academic Year: ( 2022 / 2023 )

Review date: 10-06-2021

Department assigned to the subject: Signal and Communications Theory Department

Coordinating teacher: GARCIA CASTILLO, LUIS EMILIO

Type: Electives ECTS Credits : 3.0

Year : 1 Semester : 2

## OBJECTIVES

The complexity of real communication systems requires from software tools being able to predict the behavior of different components and subsystems. The student will have a global vision about the main computational methodologies on which commercial software are based on, i.e., electromagnetic solvers.

The specific competences that will be obtained by the students are:

- Choosing the proper electromagnetic solver for each application
- Getting the know how about the mathematical modelling and numerical implementation in electromagnetic solvers.
- Knowing the computational skills in different platforms.
- Basic knowledge about HPC in computational electromagnetism

## DESCRIPTION OF CONTENTS: PROGRAMME

Practical exercise of coding about any of the following topics (Fundamentals on Computational Electromagnetics Applied to Communications I):

Lesson 0: Introduction to electromagnetic solvers.

Lesson 1: Electromagnetic mathematical modelling. Differential and integral approaches.

Lesson 2: Finite elements method, Finite differences methods, Moment method. Asymptotic techniques applied to high frequency.

Lesson 3: Implementation. Computational issues.

Lesson 4: Applications: waveguides, transmission lines, passive circuits, antennas, on board antennas, radar cross section, electromagnetic compatibility.

Lesson 5: High performance computing. Architectures and software programming MPI, OpenMP, GPUs)

## ASSESSMENT SYSTEM

Continuous Assessment. Coding a prototype implementing one of the numerical techniques of the course.

<b>% end-of-term-examination:</b>	0
<b>% of continuous assessment (assignments, laboratory, practicals...):</b>	100

## BASIC BIBLIOGRAPHY

- A. F. Peterson, S. L. Ray, and R. Mittra Computational Methods for Electromagnetics, IEEE Press, 1998
- D. B. Davidson Computational Electromagnetics for RF and Microwave Engineering, Cambridge University Press, 2010
- M. N. O. Sadiku Numerical Techniques in Electromagnetics with MATLAB, CRC press, 2009

## ADDITIONAL BIBLIOGRAPHY

- A. K. Bhattacharyya High-Frequency Electromagnetic Techniques, John Wiley & Sons, Inc., 1995
- C. A. Balanis Advanced Engineering Electromagnetics, John Wiley & Sons Inc., 1989
- J. L. Volakis, A. Chatterjee, and L. C. Kempel Finite Element Method for Electromagnetics, IEEE Press, 1998

- J. M. Jin The Finite Element Method in Electromagnetics, John Wiley & Sons, Inc., 2002
- J. M. Jin and D. J. Ryley Finite Element Analysis of Antennas and Arrays, Wiley-IEEE Press, 2009
- M. Salazar-Palma, T. K. Sarkar, L. E. Garcia-Castillo, T. Roy, and A. R. Djordjevic Iterative and Self-Adaptive Finite-Elements in Electromagnetic Modeling, Artech House Publishers, Inc., 1998
- R. F. Harrington Time Harmonic Electromagnetic Fields, McGraw-Hill, Inc., 1961