Fundamentals on computational electromagnetism apllied to communications I

Academic Year: (2021 / 2022) **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

Lesson 0: Introduction to electromagnetic solvers.
Lesson 1: Electromagnetic mathematical modelling. Differential an 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

The mark of the final exam should be equal to or greater than 3.0 over 10

Continuous Assessment. Study by student on specific subject and public presentation (75% of continuous assessment grade). Either individual work or team work of maximum two students
The other 25% consists of quiz/test about matter presented on each one of the sessions.

% end-of-term-examination:	30
% of continuous assessment (assigments, laboratory, practicals…):	70

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