ADVANCED ELECTROMAGNETICS AND SCATTERING

1. KEY INDICATORS

CFU/ECTS: 6
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2. OBJECTIVES OF THE COURSE

The course is aimed to present an overview of some advanced topics in Electromagnetics, of considerable importance for the applications. Key instruments extensively used for their physical intuition and representative power are the modal expansion with the relevant equivalent distributed circuits, and the plane-wave spectra. The concepts of Green's function and integral representation are also studied in depth. Canonical scattering problems are finally presented, and the relevant numerical techniques for the simulation of complex structures are introduced.

3. ACQUIRED ABILITIES

Knowledge and understanding: successful students will be able to have an overall vision of modern electromagnetics, with particular reference to the unifying methodological aspects and to the mathematical techniques employed, which will allow them to easily find their bearings in successive study or in job positions, due to the great generality of the faced themes. In particular, the students will have understood in depth the principal concept of guided and free propagation, as well as the approach to the scattering problem, solved both in closed form (canonical problems) and numerically.

4. PROGRAM OF THE COURSE

Planar guiding structures, equivalent transmission lines for two-dimensional waveguides. The transverse-resonance method and applications. The effective-dielectric-constant method for three-dimensional waveguides. The spectral-domain method for the study of general planar stratified structures; integral equations for the currents: numerical solution with the method of moments. Spectral decomposition of the fields radiated by an aperture. Asymptotic evaluation of integrals: integration by parts, the stationary-phase method. Computation of the far field. General introduction to electromagnetic scattering and review of principal applications. Canonical problems: scattering from cylindrical and spherical structures. Simulation of generic two- or three-dimensional scatterers.

5. REFERENCES

C.A. Balanis, Advanced engineering electromagnetic, 2nd ed., Wiley, 2012.
C.A. Balanis, Antenna Theory: Analysis and Design, 3rd ed., Wiley, 2005.
R.C. Booton, Computational methods for electromagnetics and microwaves, Wiley, New York, 1992.
Materiale integrativo (lucidi/diapositive del corso, articoli) disponibili sul sito web http://151.100.120.244/personale/frezza/AdvancedElectromagnetics.

6. COURSE WEBSITE

http://151.100.120.244/personale/frezza; http://labcem2.diet.uniroma1.it