UNIVERSITÀ DI PAVIA

Anno Accademico 2020/2021

FIELDS AND CIRCUITS

Enrollment year	2020/2021
Academic year	2020/2021
Regulations	DM270
Academic discipline	ING-IND/31 (ELECTROTECHNICS)
Department	DEPARTMENT OF ELECTRICAL,COMPUTER AND BIOMEDICAL ENGINEERING
Course	ELECTRICAL ENGINEERING
Curriculum	Sistemi elettrici
Year of study	1°
Period	1st semester (28/09/2020 - 22/01/2021)
ECTS	6
Lesson hours	45 lesson hours
Language	Italian
Activity type	WRITTEN AND ORAL TEST
Teacher	DI BARBA PAOLO (titolare) - 6 ECTS
Prerequisites	Base knowledge of electric and magnetic field in low frequency, elementary vector analysis and operators as curl, divergence and gradient. In particular, the knowledge of vector operators for field analisys is needed.
Learning outcomes	Advanced knowledge of electric, magnetic and electromagnetic fields. Base knowledge of commercial codes for finite element simulations.
Course contents	Vector fields Basic operators and equations, electrostatic field, magnetostatic field, steady conduction field. Analytical methods for solving boundary-value problems Method of Green's function. Method of images. Method of separation of

	variables. Numerical methods for solving boundary-value problems Variational formulation in two-dimensional magnetostatics. Finite elements for two-dimensional magnetostatics. Finite elements for three-dimensional magnetostatics. Time-varying electromagnetic field Maxwell's equation in differential form. Poynting's vector. Maxwell's equations in the frequency domain. Plane waves in an infinite domain. Wave and diffusion equations in terms of vectors E and H.Wave and diffusion equations in terms of scalar and vector potentials. Electromagnetic field radiated by an oscillating dipole. Diffusione equation in terms of dual potentials. Weak eddy current in a conducting plane under AC conditions. Strong eddy current in a conducting plane under AC conditions. Eddy current in a cylindrical conductor under step excitation current. Electromagnetic field equations in different reference frames (a relativistic example and Galileian and Lorentzian transformations). Computer aided design Introduction to computer aided design by means of commercial software e.g. Magnet by Infolytica or Comsol Multiphysics. Finite element analysis of a simple case study.
Teaching methods	The lectures are held with the help of blackboard and slide based presentations. Finite element codes and Matlab programming are also used. These codes are made available to students.
Reccomended or required readings	P. Di Barba, A. Savini, S. Wiak. Field models in electricity and magnetism. Springer, 2008.
Assessment methods	The final examination consists of developing a finite element simulation. The progress of the work is discussed with the teacher.
Further information	The final examination consists of developing a finite element simulation. The progress of the work is discussed with the teacher.
Sustainable development goals - Agenda 2030	$lbl_legenda_sviluppo_sostenibile