2.2.3 Electromagnetic Fields

Electromagnetic Fields

Module Summary
Module code: EEIB230
Module coordinator: Prof. Dr. Harald Sehr
Credits (ECTS): 4 Points
Semester: 2. Semester
Pre-requisites with regard to content: Basic knowledge in Mathematics and Physics
Pre-requisites according to the examination regulations: Regarding to the examination regulations no pre-requisites are required
Competencies: The students obtain a profound comprehension of electric and magnetic fields by • studying basic concepts and terms of electric and magnetic fields, • analysing and calculating magnetic circuits, • understanding the law of induction and Lenz's law, • defining the terms capacity, inductance and mutual inductance, • understanding the static and dynamic response of circuits with resistances, capacitances and inductances, • knowing and applying the four Maxwell's equations in integral form, to be able to solve practical electromagnetic assignments based on Maxwell's equations in integral form.
Assessment: Exam, 120 minutes
Usability: The contents of the parallel lecture Mathematics 2 are applied in this module. Examples of electric and magnetic fields help students to get practice applying their mathematical knowledge.

Course: Felder
Module code: EEIB231
Lecturer: Prof. Dr. Markus Graf, Prof. Dr. Rainer Merz, Prof. Dr. Harald Sehr
Scope of weekly semester hours (SWS): 4
Semester of delivery: Summer semester
Type/mode: Lecture, Compulsory subject
Language of instruction: English
Content:

- Basic Terms: electric charge, potential energy, electric field strength, electric displacement density, magnetic field strength, magnetic flux density, magnetic flux, field lines, forces in electric and magnetic fields, electric potential, voltage, current, power
- Passive dipoles (resistances, capacitances, inductances), phasor systems
- Static and dynamic response of circuits with resistances, capacitances and inductances,
- Magnetic circuits, magnetic reluctance, magnetisation loops
- Law of induction, Lenz's law
- Self-inductance and mutual inductance, transformers
- Calculation of electric and magnetic fields based on Maxwell's equations in integral form

Recommended reading:

- Hacker, V.; Sumereder, C.: Electrical engineering: Fundamentals, DeGruyter Oldenbourg, 2020
- Lehner, G.: Electromagnetic Field Theory for Engineers and Physicists, Springer, 2010
- Halliday, D.; Resnick, R.; Walker, J.: Fundamentals of Physics Extended; 10th Edition, Wiley, 2014
- Tipler, P.; Mosca, G.: Physics for Scientists and Engineers; 6th edition, W.H. Freeman, 2021