UE Advanced techniques for computational electromagnetics

ECTS
6 crédits

Composante
UFR PhITEM (physique, ingénierie, terre, environnement, mécanique)

Période de l'année
Automne (sept. à dec./janv.)

- **Langue(s) d'enseignement:** Anglais
- **Forme d'enseignement :** Cours magistral
- **Ouvert aux étudiants en échange:** Oui
- **Code d'export Apogée:** PAX9COAF
- **Temps de travail personnel pour l'étudiant:** 20

Présentation

Description

Multiphysics and multiscale problems are more and more required for solving a wide range of engineering and physical problems. Especially those that are multidisciplinary in nature. A very typical area for this is electromechanics, where the coupled nature of the electrical, mechanical and thermal parts affects the operation of the driving mechanism, which is the case for e.g. electrical machines and piezoelectric devices. Another area is electrical components where electrical effects are strongly connected to heating effects and heat transfer for the cooling of the components. Moreover, the physical mechanisms act at different scales, in materials but also in the topologies of devices (e.g. multi-stranded coils).

Due to the coupling of physics and multiscale effects, it becomes more difficult to design devices from simple guidelines and formulas. This is where numerical methods are particularly efficient.

The module gives students insight into multiphysics modeling, i.e. on the integration of different physical phenomena into a computational model, and multiscale modeling. The main topics tackled are:

- Magneto-mechanical and magneto-thermal coupling solved by Finite Element Method,

- Integral equations method for thermal problems,
- Introduction to homogenization for electromagnetic problems.

Students learn the methodical procedures that are necessary for successfully solving modeling and simulation problems in the different areas of electrical engineering. The consolidation and deepening of the theoretical knowledge is achieved on the basis of specific problems that are solved with the appropriate methods and programs. By the end of the course, students will be able to know how to do build numerical models of physical problems, develop critical thinking in interpreting results from numerical analysis, and identify incorrect results. Moreover, validate experimental results against numerical modeling.

Heures d'enseignement

CM	CM	21h
TP	TP	25h

Pré-requis recommandés

Electromagnetism, finite element method, basis in mechanical and thermal.

Période : Semestre 9

Bibliographie

- The finite element method for electromagnetic modeling, Gérard Meunier and al., Wiley-ISTE, 2008.
- Numerical methods in electromagnetism, M.V.K. Chari, S.J. Salon, Ed. Academic Press, 2000.
- Boundary Elements: An Introductory Course, C. A. Brebbia, J. Dominguez, WIT Press, 1996.

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