Master Physique fondamentale et applications
Advanced computational EM methods

Informations

Composante : Faculté des Sciences

Responsables

Gilles RENVERSEZ
Amelie LITMAN

Langue(s) d'enseignement

Anglais

Contenu

Direct methods in computational EM with the finite element method (18 hours)

This lecture will contain a theoretical part and also numerical demonstrations realized by the teacher and training classes for the students using dedicated softwares : Gmsh/GetDP for the Finite Element Method

- Finite Element Method and introduction to Gmsh/GetDP softwares
- Basic principles with a one dimensional example
- Few words on the Galerkin method and the boundary conditions
- Domain discretization and interpolating functions
- Numerical dispersion
- Vector problem and edge elements
- Eigenvalue problems in the harmonic regime (modal analysis): 1D and 2D scalar examples
- From classical Maxwell equations to their weak formulation
- Use of the mesh generator Gmsh and use of the solver GetDP : 3 simples examples
- Survey of more advanced topics (if possible) : perfect matching layers, outgoing wave condition, periodicity, vector field and 3D case, operator point of view, symmetry properties in electrodynamics and their use in numerical modelling

Inverse methods for characterization and imaging (14 hours)

Compétences à acquérir

- Understanding the theoretical basics of computational EM with the finite element method
- Knowing of the basic methodology in the correct use of numerical modelling softwares
- Know-how to use the open-source FEM softwares Gmsh and Getdp to solce simple EM problems

Modalités d'organisation

This course is a classical lecture with some excercises on computers for the finite element part.

Bibliographie, lectures recommandées

J.-M. Jin , The finite element method in electromagnetics, 3rd edition, Wiley, 2014
M. G. Larson, and rengzon , The Finite Element Method: Theory, Implementation, and Practice", Springer, 2010
J.-M. Jin , Theory and computation of electromagnetic fields, Wiley, 2010

D. Colton and R. Kress, Inverse Acoustic and Electromagnetic Scattering Theory, Springer, 2019
X. Chen, Computational Methods for Electromagnetic Inverse Scattering, Wiley, 2018
P.M. van den Berg, Forward and Inverse Scattering Algorithms Based on Contrast Source Integral Equations, Wiley, 2021

Pré-requis obligatoires

Basic knowledge in electrodynamics, guided optics, differential equations and integration in maths

Prérequis recommandés

Functional space analysis, Linear algebra

VOLUME HORAIRE

- Volume total: 32 heures
- Cours magistraux: 22 heures
- Travaux dirigés: 10 heures

Codes Apogée

- SPFCU45J [ELP]

Pour plus d'informations

Aller sur le site de l'offre de formation...

Dernière modification le 18/06/2024