Master Physique fondamentale et applications
Numerical simulation of EM problems

Informations

Composante : Faculté des Sciences

Responsables

Amelie LITMAN
Gabriel SORIANO

Langue(s) d'enseignement

Anglais

Contenu

This course introduces students to MATLAB programming and visualization of electromagnetic fields. The students will acquire an operational knowledge and firm grasp of electromagnetic fundamentals by teaching them "hands on" electromagnetics through a series of computer exercises solving optical phenomena on rigorous grounds.

The first part, "Discovering Matlab", serves as an introduction to programming languages, numerical schemes and the Matlab environment. In the second part, "Electromagnetic simulations", several examples of light matter interactions will be numerically explored by the students, ranging from diffraction to the optical responses from stratified media.

Part 1 – Discovering Matlab
1. Arrays and operators in Matlab
2. Working with files and functions
3. Graphs, 2D and 3D plots
4. Minimization and optimization

Part 2 – Electromagnetic simulations
1. Diffraction and interferences (scalar theory, Huygens-Fresnel principle, Fraunhofer)
2. Reflection/Transmission of a plane wave at a planar interface
3. Reflection/Transmission of a plane wave on a multilayer system (anti-radar coating, Bragg mirror, ...)
4. Color rendering
5. Solar cells

Compétences à acquérir

At the end of this module, the student will be able to:

- Solve real-time complex physical problems using MATLAB-based short scripts
- Implement numerical strategies to model optical multilayered media and improve their performances
- Generate graphs to illustrate and analyse electromagnetic phenomena for articles and reports

Modalités d'organisation

All sessions take place in the computer lab, with one computer per student. Students work at their own pace. For the assessment, students will be asked to reproduce results taken from scientific articles on electromagnetism and optics.

Bibliographie, lectures recommandées

"Classical Electrodynamics" John David Jackson
"Introduction to Fourier Optics" Joseph W. Goodman
"Computational Electromagnetics with MATLAB " Matthew N.O. Sadiku
"Fundamentals of Electromagnetics with MATLAB " Karl E. Lonngren

Pré-requis obligatoires

Electromagnetics, Linear Algebra, Algorithmic logic

VOLUME HORAIRE

- Volume total: 30 heures
- Travaux pratiques: 30 heures

Codes Apogée

- SPFAU24J [ELP]

Pour plus d'informations

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

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