



Courses of December

Camerino 18 - 19 December 2019
Mathematical Division - Via Madonna delle Carceri 9A

Speakers

Alessandro Fantoni

Área departamental de engenharia electrónica e telecomunicações e de computadores
Instituto Superior de Engenharia de Lisboa
Lisbona - Portugallo

Andrea Trucchia

CIMA International Center
for Environmental Monitoring
Savona - Italia

Wednesday 18

9.00

Alessandro Fantoni The FDTD algorithm for photonic waveguide analysis

- _ Introduction to Instituto Politécnico de Lisboa - Instituto Superior de Engenharia de Lisboa, with PhD thesis, MSc thesis and internship opportunities.
- _ Photonic waveguides: light-matter interaction, the complex refractive index, the Drude-Lorentz model.
- _ The FDTD (Finite Difference Time Domain) algorithm for perfect dielectrics.
- _ The Optiwave software: installing the free software version, the Optiwave user interface, material models, example of waveguide simulations.
- _ Assignment of materials for individual study and group work - literature review.

10.00

Course participants (assisted by **Alessandro Fantoni**)
Individual study and group work.

11.00

Andrea Trucchia Sensitivity Analysis and Uncertainty, Quantification in Mathematical Models

- _ Description of CIMA Research Foundation, with PhD thesis, MSc thesis and internship opportunities.
- _ Mathematical models, uncertainty, sensitivity analysis - a theoretical framework and introductory examples.
- _ Presentation on ensemble-based UQ and SA methods (Polynomial Chaos and Gaussian Processes).
- _ Assignment of materials for individual study and group work - literature review.

12.00-13.00

Course participants (assisted by **Andrea Trucchia**)
Individual study and group work.

14.00

Alessandro Fantoni

- _ The FDTD (Finite Difference Time Domain) algorithm for dispersive materials.
- _ Example of photonic waveguide devices: Directional Coupler, Y-Couplers, Ring Resonator, applications.
- _ Assignments for group work (simulation of simple waveguides. simulation of directional couplers with perfect dielectrics, simulation of directional couplers with dispersive materials).

15.00

Course participants (assisted by **Alessandro Fantoni**)
Individual study and group work - numerical experiments.

16.00

Andrea Trucchia

- _ The Python libraries to perform UQ and SA computations. Brief explanation of technical and scientific prerequisites.
- _ The implementation of Python libraries
- _ Assignments for group work (implementation of simple UQ and SA routines for test models available in literature).

17.00-18.00

Course participants (assisted by **Andrea Trucchia**)
Individual study and group work - numerical experiments.

Thursday 19

9.00

Alessandro Fantoni

- _ Presentation of the individual work, projects and these.
- _ Discussion and assignment of projects and theses.

10.00

Course participants (assisted by **Alessandro Fantoni**)
Discussion and general approach of the assigned works.

11.00

Andrea Trucchia

- _ Tutoring to students interested in the computational aspects of the proposed methods.
- _ Presentation of topics aimed at short reports, projects, MSc and BSc thesis.
- _ Handout of such topics resumes to interested students.

12.00-13.00

Course participants (assisted by **Andrea Trucchia**)
Discussion and general approach of the assigned works.

CFU recognition

1 CFU: courses' attendance and a report on the content of the courses.

2 CFU: courses' attendance, a report on the content of the courses and a short treatise/project on one of the two courses.

3 CFU: course attendance, a report on the content of the courses and a short treatise/project on both courses.