DESTEC
UNIVERSITÀ DI PISA

Dipartimento di Ingegneria dell'Energia, dei Sistemi, del Territorio e delle Costruzioni

Corso di Dottorato di Ricerca in Ingegneria dell'Energia, dei Sistemi, del Territorio e delle Costruzioni

Largo Lucio Lazzarino - 56122 Pisa (Italy) - Tel. +39 050 2217100

Invitation to the seminar

Multiphysics FEM analysis of thermal and other engineering systems with COMSOL package

held by

Paolo CONTI, PhD

Researcher in thermal and energy engineering

Venue: TBD, according to the students number

Date (tentative*)**:**

1. *Wednesday April 19th, 2023; 3:30 p.m. – 6:30 p.m.*
2. *Wednesday April 26th, 2023; 3:30 p.m. – 6:30 p.m.*
3. *Wednesday May 3rd, 2023; 3:30 p.m. – 6:30 p.m.*
4. *Wednesday May 10th, 2023; 3:30 p.m. – 6:30 p.m.*

*The dates can be rescheduled according to the availability of computer rooms.

Abstract:
Modern engineering is increasingly dealing with integrated and multi-disciplinary analyses of components and systems. Basic examples concern the thermal management of electromagnetic devices or the thermo-mechanical behavior of structures subjected to relevant thermal gradients. COMSOL Multiphysics is one of the most widespread finite-element software for multidisciplinary analysis at both research and industry level thanks to immediate GUI, the wide set of built-in modules dedicated to all the main physical phenomena, and the high level of customization of any parameter, constitutive equations, boundary and initial condition of the problem.

Despite its attractive features, the proper use of COMSOL Multiphysics requires an adequate knowledge of the simulation setup and software solution strategies. Besides, a critical analysis of the software output is always required to check the convergence and the accuracy of the solution, together with a conscious interpretation of the physical meaning of the numerical results.

The course is addressed to MS students, PhD students, post-doc researchers or anyone interested in exploring COMSOL Multiphysics for the integrated design and optimization of engineering problems with a high level of interaction between different physics. A particular focus will be dedicated to the setup of multidisciplinary numerical analysis, outputs verification and to the coupling with MATLAB® routines for the concurrent solution of problems. The course will include class exercises and live simulations concerning attendances' research areas.

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Agenda

DAY1

Fundamentals of integrated engineering design and numerical methods

- Background information and examples of integrated engineering problems
- Fundamentals of finite element methods and COMSOL solution routines
- COMSOL setup and available modules

DAY 2

Basic features of COMSOL Multiphysics

- Built-in tools for geometry set-up, material libraries, meshing process, solution routines, post-processing of the results
- Definition and customization of parameters, boundary conditions and constitutive equations
- Parametric analyses

DAY 3

Advanced and integrated features of COMSOL Multiphysics

- Multi-physics analysis and variables management
- Geometry import from CAD software
- MATLAB® LiveLink
- Examples

DAY 4

Case studies from DESTEC research areas

- Integrated analysis of thermo-electro-mechanical problems suggested by attendances