COURSE

RESEARCH BASED CONTINUING EDUCATION

Multiphysics Finite Elements

Multiphysics problems are more and more commonplace in engineering. A very typical area for this is electromechanics, where the coupled nature of the electrical and mechanical parts is the driving mechanism, which is the case for e.g. piezoelectric devices and electric machinery. Another area is electrical components where electrical effects are strongly connected to heating effects and heat transfer for the cooling of the components. Due to the coupling of physics, it becomes more difficult to design devices from simple guidelines and formulas. This is where simulation software, specifically Finite Element Methods (FEM) has its strength.

This course is given as an introduction into the fundamental concepts of multiphysics modelling and its application in Finite Element Software.
Areas covered include:

- ➜ The concept of elements
- ➜ Boundary and coupling conditions
- ➜ Convergence

The aim is to give a thorough understanding of FEM, its abilities and pitfalls. This includes a brief example of solving a simple FEM in Matlab and evaluation of results from commercial software. In this course, both Ansys and Comsol Multiphysics can be used as FEM software, noting that the lecturers are mostly experiences with Comsol Multiphysics.
The course was developed by researchers of the Mads Clausen Institute.

Benefits
On the course you will receive:

- ➜ A solid fundamental knowledge of the principles behind FEM
- ➜ Mechanisms of solving Multiphysics problems in general and FEM
- ➜ Guidance for using commercial FEM software like Ansys and Comsol
- ➜ Knowledge about evaluating FEM results
- ➜ Knowledge of commonly used FEM numerical solvers
- ➜ Opportunity to exchange experiences and network with colleagues

Audience
The course content is addressed to skilled professionals working in different industrial sectors.
Basic knowledge of engineering and/or physics corresponding to a bachelor, civil engineer, professions bachelor or similar is expected. Knowledge of programming in Matlab or other mathematical software is recommended. More specifically, the participant is expected to understand and be able to perform

- ➜ Integration of polynomials
- ➜ Basic differentiation
- ➜ Matrix multiplication/determinants

Time and place
21.-23. January 2015
The course is held at University of Southern Denmark, Sønderborg campus

Price
9.000 kr. excl. VAT
The price includes tuition, materials and meals during the course days.
The price does not include accommodation.

Registration
Deadline 12. December 2014
On our website: www.sdu.dk/sdue

SYDDANSKUNIVERSITET.DK

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Program

Day 1 Morning:
Intoduction to Finite Element Methods

➜ Refreshing Ordinary and Partial Differential Equations
➜ The concept of Elements
➜ Residual and Weak Formulation
➜ Exercise with a 1D problem

Day 1 Afternoon: Boundary Conditions

➜ Boundary Conditions general and in FEM
➜ Introduction to multiphysics
➜ Exercise with a 1D multiphysics problem

Day 2 Morning: Convergence

➜ Concept of convergence
➜ How to check for convergence
➜ Exercise with 2D problem

Day 2 Afternoon: Hands on Multiphysics Problem

➜ 2D or 3D multiphysics problem
• Heat and mechanical coupling
• Electrical Machines

Day 3 Morning: Solvers

➜ Direct Solvers – Gauss elimination and variants
➜ Interative Solvers
• Steepest Decent
• Conjugate Gradient
• Multigrid Methods
➜ Convergence for time dependent problems

Day 3 Afternoon: Starting up your problem type

➜ Getting started on real problems from participants
➜ Optional predefined problems

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Learn more on www.sdu.dk/sdue

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