Simulation Methods II – Introduction to Computational Fluid Dynamics and Heat Transfer

Course number	7240
Hours per week:	4
ECTS:	5
Scheduled:	Winter Term
Format	Lecture
Examination:	Oral exam (15 min.)
Lecturer:	Prof. Dr. Sautter
Objectives:	**Knowledge:** The students have an overview of modelling processes in the fields of thermodynamics and fluid dynamics and applications thereof. They know basic numerical methods and simulation software to simulate such processes. **Skills:** The students can simulate fundamental processes in the fields of thermodynamics and fluid dynamics with MATLAB and they can use application-specific simulation software. **Competences:** The students are able to simulate time dependent heat transfer and incompressible fluid flow in simple geometries and can interpret and analyze the results. They are able to solve a simulation problem independently and present the results.
Contents:	Elliptic and parabolic problems in 1D and 2D Finite difference method in 1D and 2D Computational thermodynamics: - principles of heat transfer: conduction, convection, radiation - heat equation and its numerical solution Introduction to COMSOL Multiphysics Wind- and Hydropower Computational fluid dynamics: - introduction to fluid dynamics - modeling fluid flow - numerical simulation of incompressible fluid flow - applications of CFD Introduction to FEM Simulation project: - project planning - problem solving - documentation and presentation of the results
Pre-requisites	Engineering Mathematics I & II, Computer Science I & II, Simulation Methods I
Recommended Reading:	Andersson B./et al.: Computational Fluid Dynamics for Engineers, Cambridge University Press Cebeci/et al.: Computational Fluid Dynamics for Engineers, Springer-Verlag Chapra, S.: Applied Numerical Methods with MATLAB for Engineers and Scientists, McGraw-Hill

	Chattot, J.-J.: Computational Aerodynamics and Fluid Dynamics, Springer-Verlag Griebel, M./et al.: Numerical Simulation in Fluid Dynamics: A Practical Introduction, SIAM Munz, C.-D./Westermann, T.: Numerische Behandlung gewöhnlicher und partieller Differenzialgleichungen – Ein interaktives Lehrbuch für Ingenieure, Springer-Verlag Polifke, W./Kopitz, J.: Wärmeübertragung – Grundlagen, analytische und numerische Methoden, Addison-Wesley Verlag All books in the current edition