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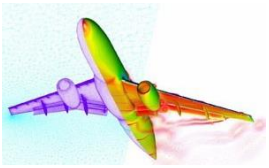
Syllabus for



SARC-CFD-01 – Computational Fluid Dynamics

CREDITS	7.5 credits
EXAMINER	Philipp Schlatter (KTH)
CONTACT	**ARDESHIR HANIFI (KTH)** hanifi@kth.se **PHILIPP SCHLATTER (KTH)** pschlatt@mech.kth.se
TARGET GROUP	Doctoral students in aeronautics who want to gain knowledge in computational fluid dynamics.
AIM	The aim of this course is to give students basic knowledge in computational fluid dynamics by introducing them to some of basic concepts and methods. The students not having a background in either fluid mechanics or numerical analysis are introduced to these subjects through some introductory lectures.
PREREQUISITES	Doctoral students in aeronautics with basic background in either fluid dynamics or numerical methods and basic knowledge in programming.
LEARNING OUTCOMES	After reading this course the student should be: • familiar with the differential equations for flow phenomena and numerical methods for their solution • able to use and develop flow simulation software for the most important classes of flows in engineering and science. • able to critically analyse different mathematical models and computational methods for flow simulations • able undertake flow computations using current best practice for model and method selection, and assessment of the quality of results obtained.

CONTENTS	Short introduction with review of other numerical methods or the basic equations of fluid dynamics (the class will be divided in two groups). Conservation laws: the Navier-Stokes equations. Different levels of approximation, the Euler and Reynolds Averaged equations. Turbulence models. Basics of finite approximations for partial differential equations. Mathematical properties of hyperbolic systems. Numerical treatment of shocks. Finite volume and finite element methods. Boundary conditions. High-resolution methods. Grid generation. Practical algorithms for compressible and incompressible flow. Computer exercises with methods for the Euler equations in 1D and different approximations for 2D compressible and incompressible flows.
ORGANISATION	Three physical meetings at KTH, 2 days per meeting. One one-day examination.
LITERATURE	Lecture notes Relevant books: • Numerical Computation of Internal & External Flows, Charles Hirsch, Butterworth-Heinemann, Second Edition, ISBN: 978-0-7506-6594-0. • Computational Fluid Dynamics, John D. Anderson, Jr., McGraw-Hill, 1995
EXAMINATION	The examination is in two parts: • a written exam. • a set of homework and a project. The grade is passed/not passed.
FEE FOR INDUSTRIAL MEMBERS	--
REMARKS	