



FSG3114 Numerical Methods in Fluid Mechanics 7.5 credits

Numeriska metoder i strömningsmekanik

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

Establishment

The course syllabus is valid from Spring 2023 according to the school principal's decision: S-2022-1530 Decision date: 2023-01-31

Grading scale

P, F

Education cycle

Third cycle

Specific prerequisites

1. A course in computer science or programming (e.g. DD1337);
2. Background in either fluid dynamics or numerical methods, corresponding to one of the second level courses in numerical methods, e.g. SF2520, 2521, 2561, or a course in fluid dynamics e.g. SG2214 or equivalent.
3. English B

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended 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.

Course contents

Short introduction with a review of other numerical methods or the basic equations of fluid dynamics. Conservation laws: the Navier-Stokes equations.

Different levels of approximation, the Euler and boundary-layer equations. Basics of finite approximations for partial differential equations.

Mathematical properties of hyperbolic systems. Numerical treatment of shocks. Finite difference and volume methods. Boundary conditions. High-resolution methods. Coordinate transformation and grid-quality assessment. 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.

Examination

- LAB2 - Computer assignment, 4.5 credits, grading scale: P, F
- TEN1 - Written exam, 3.0 credits, grading scale: P, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

Other requirements for final grade

One written examination with minimum performance that corresponds to grade B for the Master's course SG2212 (TEN1) 3,0 hp.

Homework and computer assignments (LAB1) 4,5 hp. Compared to the corresponding moment in SG2212 (LAB1) 4,5 hp required completion of an extra assignment.

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.