

**Numerical Solution of Initial Boundary Value Problems, 3.0 credits**

Numerisk lösning av initial och randvärdesproblem, 3.0 hp

Third-cycle education course

MAI0122

Dept of Mathematics

Valid from: First half-year 2023

**Approved by**  
Head of Department

**Approved**

**Registration number**

## Entry requirements

Good general knowledge in: calculus, integrals, differentiation, fouriertransforms, linear algebra, functional analysis, programming.

## Contents

1. General principles and ideas. Periodic solutions and Fourier analysis. The Petrovski condition for the PDE and the von Neumann condition for difference schemes.
2. The energy method. Semi-bounded operators. Symmetric and skewsymmetric operators. Well-posed boundary conditions in practise. The error equation. Energy estimates. Accuracy of discrete approximation.
3. High order finite difference methods. Boundary treatment. Summation by parts (SBP) operators. Weak boundary conditions. Strict/time stability.
4. Extension to multiple dimensions. Structured multi-block methods. Unstructured finite volume methods and discontinuous Galerkin methods. Stability and conservation.

## Educational methods

6 Lectures, 3 excersises, 3 seminars. Approximately 20 hours.

## Examination

3 mandatory HWs.

## Grading

One-grade scale

## Course literature

Lecture notes and reference to relevant articles.