

# 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.

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.
High order finite difference methods. Boundary treatment. Summation by parts (SBP) operators. Weak boundary conditions. Strict/time stability.
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.

