UNIVERSITY OF GOTHENBURG

DEPARTMENT OF MATHEMATICAL SCIENCES

MMF910 Numerical methods for ODEs, 7.5 credits

Numeriska metoder för ordinära differentialekvationer, 7,5 högskolepoäng

Second Cycle

Confirmation

This course syllabus was confirmed by Department of Mathematical Sciences on 2023-03-24 to be valid from 2023-08-28, autumn semester of 2023.

Field of education: Science 100%
Department: Department of Mathematical Sciences

Position in the educational system

Main field of studies	*Specialization*
Mathematics	A1N, Second cycle, has only first-cycle course/s as entry requirements

Entry requirements

For entrance to the course, knowledge corresponding to the courses Linear algebra MMG400 and multivariable calculus MMG300, and good working knowledge of a programming language is required.

Learning outcomes

On successful completion of the course the student will be able to:

- account for a broad knowledge of the numerical analysis of classical numerical methods for ODEs, for instance: linear stability analysis, Runge--Kutta methods, splitting methods;
- implement and use a variety of numerical methods for ODEs;
- apply geometric integrators (for example symplectic integrators to Hamiltonian systems).

Course content

Ordinary differential equations (ODEs) often appear in the dynamical description of systems in physics, chemistry, biology, etc. It is only in particular cases that one can derive explicit solutions to ODEs: a numerical approximation is needed. The course covers numerical methods for ODEs such as Runge-Kutta methods and their linear stability analysis. Depending on the interest of the participants, more specialized topics will be covered. Examples of such specialized topics are: numerical methods for stiff problems, geometric numerical methods (i.e. structure-preserving numerical methods), Lie group integrators, or geometric mechanics.

Exercises will illustrate and complement the theory presented during the lectures. Computer exercises illustrate the implementation and use of the presented numerical methods on small-scale problems.

Form of teaching

Course lectures, exercises, and computer labs.

Language of instruction: English

Assessment

Assessment will be based on an oral examination (possibly in form of a presentation to the class), mandatory exercises, and small computational projects.

If a student who has twice received a failing grade for the same examination component wishes to change examiner ahead of the next examination session, such a request should be made to the department in writing and should be approved by the department unless there are special reasons to the contrary (Chapter 6 Section 22 of the Higher Education Ordinance). If a student has received a recommendation from the University of Gothenburg for study support for students with disabilities, the examiner may, where it is compatible with the learning outcomes of the course and provided that no unreasonable resources are required, decide to allow the student to sit an adjusted exam or alternative form of assessment. In the event that a course has ceased or undergone major changes, students are to be guaranteed at least three examination sessions (including the ordinary examination session) over a period of at least one year, but no more than two years after the course has ceased/been changed. The same applies to internships and professional placements (VFU), although this is restricted to just one additional examination session.

Grades

The grading scale comprises: Pass with Distinction (VG), Pass (G) and Fail (U).

Course evaluation

The course evaluation is carried out together with the students at the end of the course

and is followed by an individual, anonymous survey.

The results of and possible changes to the course will be shared with students who participated in the evaluation and students who are starting the course.