



LUNDS UNIVERSITET  
Lunds Tekniska Högskola

*Course syllabus*

# Avancerad kurs i numeriska algoritmer med Python/SciPy

## Advanced Course in Numerical Algorithms with Python/SciPy

**FMNN25, 7,5 credits, A (Second Cycle)**

**Valid for:** 2023/24

**Faculty:** Faculty of Engineering, LTH

**Decided by:** PLED F/Pi

**Date of Decision:** 2023-04-18

### General Information

**Elective for:** D4, E4-pv, F4, F4-bs, F4-fm, MSOC2, Pi4-bs, MMSR2

**Language of instruction:** The course will be given in English

### Aim

The course is intended as an algorithm oriented complement to most of the basic and specialized courses in numerical analysis, which are focused on analysis of methods. The course emphasizes the coupling between complex numerical algorithms and modern programming languages.

### Learning outcomes

#### *Knowledge and understanding*

For a passing grade the student must

- be able to account for the basic principles of computational algorithms.
- be able to describe a number of important computational problems, and ways to attack them, in detail.

#### *Competences and skills*

For a passing grade the student must

- be able to write computational programmes at a high level.
- be able to code, test and evaluate the results of complex numerical algorithms, using established programme libraries.

- be able to carry out a group programming project, including identifying subproblems, distribution of tasks within the group and responsibility for the completion of his/her task.
- be able to account for a computational project, both in a written report and orally.

## Contents

Introduction to Python for students already familiar with other programming languages. The use of object oriented programming in scientific computing. Scipy/Numpy datastructures.

Examples of complex numerical algorithms from various subjects in numerical analysis,

Coupling to advanced numerical libraries in C and Fortran (Netlib).

Automatic tests in scientific computing. Graphical representation of mathematical results (animation). The use of Python to control system processes.

The course may be complemented with special contributions of invited guest teachers.

## Examination details

**Grading scale:** UG - (U,G) - (Fail, Pass)

**Assessment:** A larger programming project to be carried out in group, and to be presented at a seminar. Opposition on the report of another group. Compulsory attendance at all presentations.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

## Admission

**Assumed prior knowledge:** Basic course in numerical analysis. Programming experience in some of the languages Java, C, C++, Fortran, Python and Matlab.

**The number of participants is limited to:** 60

**Selection:** Completed university credits within the programme according to Ladok. (For students in master's programmes 180 credits corresponding to a bachelor degree are added.) Priority is given to students enrolled on programmes that include the course in their curriculum.

**The course overlaps following course/s:** NUMN25, NUMN21

## Reading list

- Führer, C, Solem, J.E., Verdier, O.: Scientific Computing with Python 3, Second Edition. Packt Publishing, 2021, ISBN: 9781838822323.

## Contact and other information

**Director of studies:** Anders Holst, studierektor@math.lth.se

**Course administrator:** Student Office, expedition@math.lth.se

**Course coordinator:** Andreas Langer, Andreas.Langer@math.lth.se

**Course homepage:** <https://canvas.education.lu.se/courses/20391>