Validated Numerics

The course Validated Numerics 1MA227 consists of 25 sessions: 13 lectures, 6 problem sessions, 5 computer labs and 1 seminar. This course will be given in English.

Learning Outcomes
In order to pass the course the student should be able to

- account for the floating point system at modern computers;

- account for the basic interval analysis;

- use the inclusion principle to verify/falsify mathematical statements;

- implement simple algorithms for computer-aided proofs;

- use technologies for automatic derivation;

- solve problems in optimisation, equation solution and quadrature using validated numerics;

- account for inclusion methods for ordinary differential equations;

- handle software for validated numerics.

Course literature
Tucker, W., *Vadiated Numerics: a short introduction to rigorous computations.*

Lecture plan

Preliminary lecture plan		
Session	Type of session	Contents
1	Lecture	Introduction to the course.
2	Lecture	Computer Arithmetic (I)
3	Lecture	Computer Arithmetic (II)
4	Problem session	Computer Arithmetic
5	Computer Lab	Computer Arithmetic
6	Lecture	Interval Arithmetic (I)
7	Lecture	Interval Arithmetic (II)
8	Problem session	Interval Arithmetic
9	Lecture	Interval Analysis (I)
10	Lecture	Interval Analysis (II)
11	Problem session	Interval Analysis
12	Computer Lab	Interval Arithmethic and Analysis
13	Seminar	What are Computer Assisted Proofs? Can we consider them a mathematical proof?
14	Lecture	Automatic Differentiation (I)
15	Lecture	Automatic Differentiation (II)
16	Problem session	Automatic Differentiation
17	Computer Lab	Automatic Differentiation
18	Lecture	Interval Arithmetics in Action (I)
19	Lecture	Interval Arithmetics in Action (II)
20	Lecture	Interval Arithmetics in Action (III)
21	Problem session	Interval Arithmetics in Action. Case study.
22	Computer Lab	Interval Arithmetics in Action
23	Lecture	Ordinary Differential Equations
24	Problem session	Ordinary Differential Equations
25	Computer Lab	Ordinary Differential Equations

Examination

The course is passed if the student satisfies **all** bullets stated in the Learning Outcomes. This will be assessed by means of three written homeworks and the computer labs.