Numerical methods for Ordinary Differential Equations

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Timetable: 12 hrs. First lecture on January 12, 2016, 15:00, (dates already fixed, see the calendar), Torre Archimede, Room 2BC/30.

Course requirements: it is advisable to have attended a basic course in Numerical Analysis.

Examination and grading: Written exam.

SSD: MAT/08 Numerical Analysis

Aim: We present basic numerical methods for initial value problems in ordinary differential equations and we analyse their convergence properties.

Course contents:

• Existence and uniqueness of the solution and continuous dependence on the data for the initial value problem $y'(x) = f(x, y(x)), y(x_0) = y_0$.

• Classical Lipschitz constant and right hand side Lipschitz constant.

• General one-step methods; explicit and implicit Runge-Kutta methods.

• Definition of local truncation and discretization error for one-step methods and definition of consistency of order $p$.

• Convergence theorem with order $p$ for one-step methods. Order conditions for Runge-Kutta methods. Order barriers for explicit and implicit methods.

• Variable stepsize implementation. Embedded pairs of methods of Runge-Kutta-Fehlberg type.

References:


3. Lecture notes by the professors.