

Numerical integration of dynamical systems

Prof. Assyr Abdulle

<http://anmc.epfl.ch/Numerical.html>

Autumn 2014, tentative outline

I Geometric integration of dynamical systems

- I.1 Examples and first definitions
- I.2 Runge-Kutta methods
- I.3 Collocation methods
- I.4 Partitioned Runge-Kutta methods
- I.5 Numerical conservation of invariants
- I.6 Symmetric integration
- I.7 Symplectic integration
- I.8 Symplectic numerical methods

II Numerical integration of stiff problems

- II.1 Examples
- II.2 Linear stability, motivation, limitation
- II.3 Stability of Runge-Kutta methods (A,L-stability, characterization)
- II.4 Rational functions related to collocation methods (order stars)
- II.5 Implementation of implicit Runge-Kutta methods
- II.6 Runge-Kutta Chebyshev methods

Bibliography:

- E. Hairer and G. Wanner, “Solving Ordinary Differential Equations II”, second revised edition, Springer, Berlin, 1996.
- E. Hairer, C. Lubich and G. Wanner, “Geometric Numerical Integration”, second edition, Springer, Berlin, 2006.
- B. Leimkuhler and S. Reich, “Simulating Hamiltonian Dynamics”, Cambridge University Press, 2005.