Institute of Scientific Computing
Technical University Braunschweig
Dr. Thilo Moshagen
Dr. Anna Veselovska

Summer Term 2019

Advanced Methods for ODE and DAE:
Assignment 3

Exercise 1: *due date: 17.5.* **(10 points)**

Set up the general spring mass model with N masses, analogously to Keplers problem, as first-order system. Prove that its solutions are stable in the sense of Lyapunov, you can proceed as in tutorial (using Hamiltonian). A little pdf is on studip to simplify the start for you.

Exercise 2: *due date: 10.5.* **(36 points)**

(a) Implement a general (A, b, c are parameters) implicit RK method, using a Newton solver, in python, using A, b, c of a method of order p. The points are for design. (8 points)

(b) Apply it to $\dot{x} = \lambda x$, $\lambda < 0$. The points are for code working for 1D problem. (8 points)

(c) Apply it to a 2-spring 2-mass problem. The points are for code working for 4D problem and problem itself. (12 points)

(d) due date: 17.5. Make convergence plots for comparing two methods of different order of your choice, using one of the above problems or one of your interest. (8 points)
Do not forget plots.