

Advanced Methods for ODE and DAE:
Little Project

This is to prepare repeating course.

Do not take the marks literally. The due date is in two weeks. Dishu helps during/after tutorials, but does not *do* the tasks.

Exercise 1: (44 points)

The code in `simTruss.py` calculates the displacements of nodes of a truss system. A very simple such system, ideal for programming and testing purposes, is given in `trusses.py`. The code can be run by itself or `unittest.py`.

- (a) Write a documentation for the code, more precisely: Write down the physical principles that model the system and the equations that are derived from them and are implemented in the code. (8 points)
- (b) Fill the given `unittest.py` with life by some problems with known solution, e.g. 1-2 single trusses. (8 points)
- (c) The calculated displacements are a stable state. Now model that the truss system has inertia, this means: masses in the nodes, and so becomes time dependent, modeled by ODE (8 points)
- (d) Produce code implementing that ODE that fits into the ODE right hand side syntax that you used when implementing past solvers. (8 points)
- (e) Make Eigen analysis of the system. (4 points)
- (f) Write a report that examines the properties of numerical solutions of the solvers you implemented so far. Make convergence plots. (8 points)