

Masterthesis

Adaptive time stepping for FEM computations

Motivation

In Micro-Electro-Mechanical Systems (MEMS) highly non-linear effects can play a significant role when describing the underlying physical principles. In our in-house Finite Element program *openCFS*, many of those effects can already be simulated. Highly non-linear effects such as contact-forces require very small time steps in order to resolve the process accurately in time. All time stepping schemes in *openCFS* currently use a fixed time step, whether the scheme is explicit or implicit. In this project, an adaptive time stepping scheme BDF2 and Newmark should be implemented.

Research Questions

The goal of this thesis is to implement and test adaptive time stepping schemes where the time step is adapted according to a law based on information available during the non-linear sub-iterations. The final implementation shall be tested on a readily available simulation setup of a MEMS device.

Tasks

- Literature research
- Implement adaptive time stepping (programming language is C++)
- Test implementation

Organisation

- Language: German/English
- Start: As soon as possible
- Prerequisites: Programming in C++
- General FEM knowledge is advantageous but not necessary

Contact/Supervisor

Dominik Mayrhofer
Inffeldgasse 18/I
dominik.mayrhofer@tugraz.at
HSEG086

Reduce time step when large gradients of the RHS (e.g. non-linear forces) occur

