University of Stuttgart
Institute of Applied Mechanics

MSc./BSc. thesis
SimTech PA/FM
COMMAS SL

Space-Time Reduced Order Modeling

The simulation of cyclic problems in the presence of physical nonlinearities such as plasticity, viscosity and/or damage is particularly challenging: Instead of solving a nonlinear high-dimensional system once, thousands or millions of load cycles need to be simulated.

The use of the LATIN method and the related Space-Time Reduced Order Model [1] provides an efficient workaround for solving this task. In its current form it is limited to the class of *Generalized Standard Materials (GSM)*. It divides the cyclic problem into coarse time intervals and applies a monolithic space-time solver on each interval. The numerical performance is leveraged by using a reduced basis defined with respect to a de-dimensionalized time.

In this thesis the method will be generalized towards general plasticity and viscoplasticity. This will serve as a proof of concept for subsequent generalizations.

Reference

[1] F. Fritzen, M. Hassani. *Space–time model order reduction for nonlinear viscoelastic systems subjected to long-term loading.* Meccanica 53:6, p. 1333-1355, 2018.

Tasks

- generalization w.r.t. constitutive models
- a non-intrusive approach will be favored
- proof of concept implementation in Python
- apply the method to benchmark problems

Technical requirements

- python knowledge
- preferably knowledge in the modeling of plasticity
- ideally prior experience with reduced order modeling

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