Associate Professorship of Computational Mechanics
Department of Geo, Civil and Environmental Engineering
Technical University of Munich

Software Lab:

Physic-based Machine Learning

Modeling: ★★★☆☆
Mathematics: ★★★★☆
Programming: ★★★☆☆
Science: ★★★★★

Setting

In the design process repeating simulation of complex FEM-models are very time consuming. Therefore model order reduction techniques can be used to simplify the model to a smaller scale. For nonlinear problems the results of multiple test simulations from a FEM solver are collected in a so called snapshot matrix. With a mathematic evaluation (POD) of the snapshot matrix the dominant deformation patterns are filtered out as shwon in the figure. In combination with a machine learning approach a simple model to predict the system behaviour should be created [1].
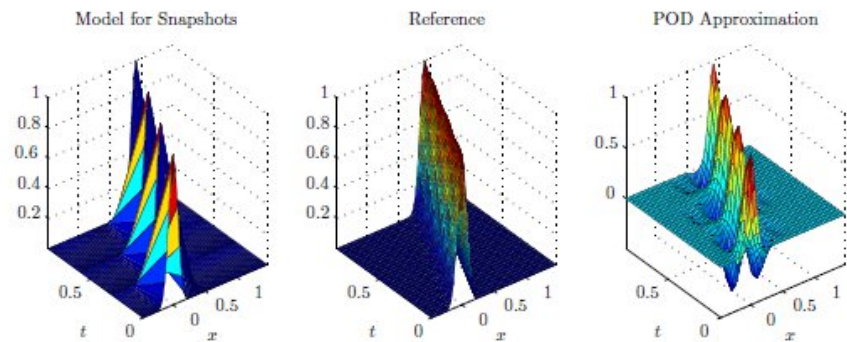
Task
Combine the existing Python solver with a machine learning model:

- Literature review in order to get familiar with the topic
- Extending an exisiting model order reduction algorithm in python
- Implementing a machine learning approach (e.g. k-Nearest Neighbors) and evaluate the reduced model

Supervisors

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References

[1] R. Swischuk et al., Projection-based model reduction: Formulations for physics-based machine learning, Com- puters and Fluids 179 (2018), pp. 704-717.