GREY-BOX REDUCED ORDER MODELLING OF COMSOL MODELS

Context

Intrusive ROM methods need specific details of the model (think of e.g., the stiffness matrix, boundary conditions) to build a reduced model. Commercial FEM solvers often do not expose all the information necessary to use intrusive methods. In that case one can use grey/black-box techniques that try to infer the missing information needed for model reduction from the given data.

However, a drawback is loss of accuracy of the reduced model, or loss of speed-up compared to an intrusive method that has all information available. Sioux wants to investigate these methods and drawbacks and evaluate in which uses cases ROM methods can be used with commercial solvers.

Activities

- Setup COMSOL-Python interface
- Apply/implement grey-box ROM techniques in Python for a model use case
  - (parametric) Heat transfer problem: Lens heating
  - (If time allows) thermo-mechanical problem: Thermal deformation of the lens
- Compare performance between original COMSOL model and reduced model.

Internship overview

- Master
- Internship
- Mathware
- Location: Eindhoven

Technologies

- Reduced order modelling
- Finite element methods, COMSOL
- Heat transfer
- Python

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Assignment

Simulating high-fidelity models is often computationally expensive. Reduced order modeling (ROM) techniques try to find a low dimensional approximation of the high-fidelity model. These reduced models are computationally less heavy to solve and can speed up simulation times significantly.

This enables the use of complex models in situations where these models need to be evaluated quickly a lot of times. Uses cases are e.g., the coupling of FEM models in a (real-time) control loop or system level model or for (interactive/automatic) optimization of parameters of the model.

The goal is to use state-of-the-art ROM techniques in combination with Commercial FEM solvers. The challenge is that commercial solvers usually do not expose all necessary information for some ROM techniques. However, techniques exist to infer/approximate the missing information. The task is to implement promising techniques on several finite element problems and analyze their accuracy and speed up.

Why choose Sioux?

- Working on innovative technology
- Challenging, dynamic and varied work
- A comfortable and personal work environment
- Plenty of opportunities for personal development
- Great carreer opportunities
- Contributing to a safe, healthy and sustainable society

Get in touch!
Would you like to know more about this student assignment?

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