Introduction to Structural Optimization
- Proposed Projects

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Projects

- final project for lecture (extended homework)
- 10 ECTS software project (BGCE)
- topics for master theses

Final Project

- presentation: January
- individual projects (no group work)
- a topic can be chosen by more than one person
- guests will be invited (fellow Phd students, Prof. Stingl)
- you can get remote access to manni (96 cores, 512 GBytes RAM)

Structure of Final Project

- feedback during project phase
- presentation of draft before presentation
- 20 minutes presentation
- 5 minutes questions from the auditorium

Projects

- solve appealing standard problems
- 3D-Printing
- solve challenging problems
- report on papers
- ideas from you?

Standard Problems

- compliance, force inverter
- high-resolution 3D problems
- different problems for one presentation
    - bridge
    - dam
    - chair
    - Airbus FCRC bracket
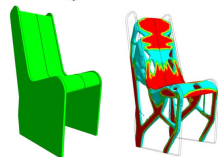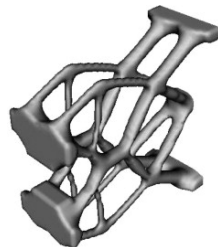
Challenge

- generate mesh (coreform Cubit, Gmsh, Python)

gripper: TAKEZAWA, NISHIWAKI, KITAMURA; 2010
chair: MIDAS NFX   bracket: AIRBUS/ TU-HH

3D-Printing

- generate 3D design
- print via 3D printer
- you need to find a 3D printing service (e.g. fablab?)
- you need to convert mesh (Paraview $\rightarrow$ STL)
- up to 50€ for printing cost provided
- you need to provide the printed object
- ideally one object for the lecturer :)
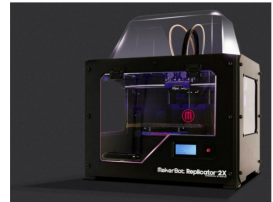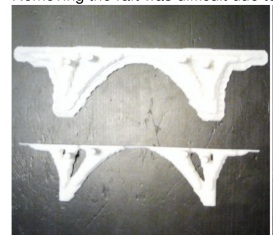- report about technology, process, . . .

Image: eu.makerbot.com

Challenge

- make it in time

image: PAUL MILDENBERGER; 2014

Report on Papers

General

- summarize paper
- classical seminar talk

Lattice Boltzmann Method

- summarize paper
- calculations with openCFS

Feature Mapping

- pure paper talk
- state of the art topics

. . .

Current Highlight

Sukhminder's project

- MPI-parallel optimization of chair
- parallel FEM code DUNE extended by density filter
- combined with parallel TopOpt solver from DTU
- multiload optimization

Enhance openCFS (good C++ skills)

- integrate linear system solvers from Trilinos
- speed up openMP assembly of linear system
- reactivate PETSc mode (MPI-based)
- make MMA more robust (Python and/or C++)
- . . .

Extract of Master Thesis

- possibly an extract of a master thesis topic?

Acoustic Topology Optimization

- acoustic problem
- time harmonic
- DÜHRING, JENSEN, SIGMUND; ACOUSTIC DESIGN BY TOPOLOGY OPTIMIZATION; 2008
- 98% in openCFS (was there in a former version)
- combine with openCFS shape optimization
- applications together with Prof. Kaltenbacher, TU-Wien
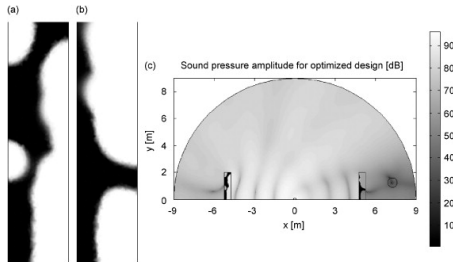
Catalyst Reactor

- optimization of reaction of a catalyst reactor
- Okkels, Bruus; Scaling behaviour of optimally structured catalytic microfluid reactors; 2007
- adjoint sensitivity analysis necessary
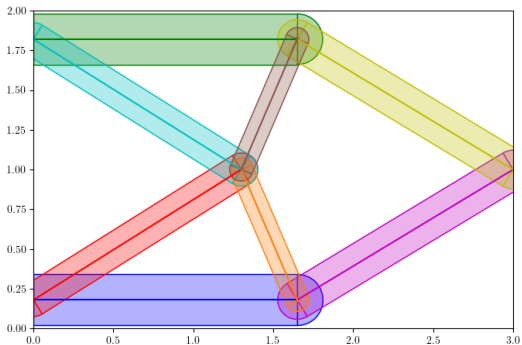- combination with LBM instead of Navier Stokes
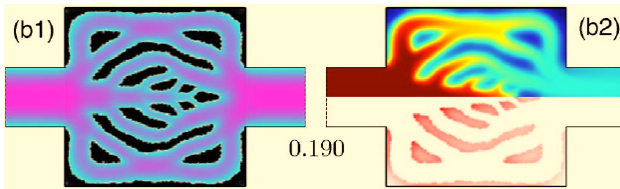
Solar Air Heater

- solar air heater
- CFS modelling
- optimization
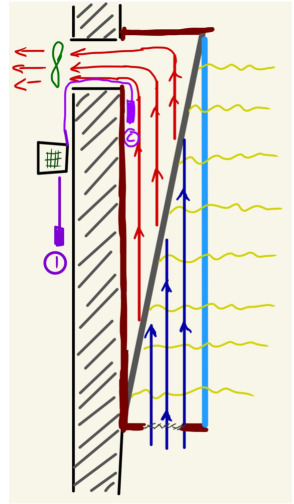
Feature-Mapping Optimizer

- fine tune MMA
- respect feature-mapping
- gradient → asymptotes

Carbon Fiber Reinforced Printing

- continuous carbon fiber

- discrete layer opt exists

- tune parameters