Department of Numerical Analysis and Scientific Computing
Simula Research Laboratory
Oslo, Norway

Optimization in Oslo

A Seminar Series on Continuous Optimization

Date:
Wednesday October 26, 2022 at 14:00 (GMT+2, CEST)

Speaker:
Dr. Niels Aage
Technical University of Denmark

Title:
Ultra-high resolution structural optimization: Current state-of-the-art and new frontiers

Abstract:
Structural optimization methods, specifically tailored to efficiently solve very large scale design problems, are experiencing a steady increase in interest from both academia and industry. The availability of such design tools allows researchers and engineers to gain unprecedented insight into complex physical problems at multiple scales, i.e. ranging from material design to giga-scale structures such as full aircrafts and suspension bridges.

This talk will focus on some of the key challenges arising in the solution of very large scale topology and shape optimization problems. Examples include the use of high performance computing (HPC) platforms for the design of large scale civil engineering structures such as suspension bridges. Besides the need for highly efficient iterative solvers for the partial differential equations, another issue arising in large scale structural optimization is the problem of including local constraints, such as maximum stress constraints and/or manufacturing constraints. Several approaches will be discussed including p-norm aggregations and classical methods such as augmented Lagrangian formulations.

Despite the successful use of HPC for structural optimization, the required computing facilities are not readily accessible for everybody and even when they are, access comes at a significant financial cost. Therefore, new and

easily accessible approaches allowing for high resolution structural optimization on desktop computers are highly desirable. Approaches including the use of GPUs and matrix-free methods, de-homogenization and machine learning will be discussed.

Brief Bio:
Dr. Niels Aage is an Associate Professor of Solid Mechanics and Optimal Design at the Technical University of Denmark and member of the DTU TopOpt group. His research interests include the development of new methods for structural optimization, efficient numerical methods for giga-scale optimization, multiphysical design optimization and educational tools for structural optimization. Prof. Aage has authored more than 46 papers in ISI indexed journals, including three highly cited in the field. He has been invited speaker and keynote lecturer at multiple scientific conferences and has received prizes for his pioneering work on giga-scale computational morphogenesis published in Nature. Furthermore, he has developed specialized structural optimization open-source codes tailored for use on high-performance computing systems. See more on www.topopt.dtu.dk.