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APPLIED MATHEMATICS SEMINAR 291

On The Length Scale, Robustness And Manufacturability In Topology Optimization

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Date: **9/15/17**
Time: **3:00 PM**
Location: **COB 110**

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ABSTRACT

Topology optimization has gained the status of being the preferred optimization tool in the mechanical, automotive, and aerospace industries. It has undergone tremendous development since its introduction in 1988, and nowadays it has spread to many other disciplines such as acoustics, optics, and material design. The basic idea is to distribute material in a predefined domain by minimizing a selected objective function and fulfilling a set of constraints. The procedure consists of repeated system analyses, gradient evaluation steps by adjoint sensitivity analysis, and design updates based on mathematical programming methods. The existence of a solution is ensured by regularization techniques which result in intermediate density material regions. Manufacturing of the final optimized design requires post processing. However, any amendments can nullify the effect of the optimization. Therefore, the aim of this talk is to present recent developments in obtaining black and white manufacturable designs with clearly defined length scale. The focus is on the mathematical modeling of the material density, its link to micro- and nano- scale production techniques, and on the introduction of uncertainties in the optimization. The unified model results in manufacturable black and white designs with performance which is robust with respect to variations in the production process.

BIO:

Boyan Lazarov is a Senior Lecturer in the School of Mechanical, Aerospace and Civil Engineering at the University of Manchester, UK. He is currently also a visiting professor at the Lawrence Livermore National Laboratory, US. Prior to joining the University of Manchester, Boyan held faculty and postdoc positions at the Technical University of Denmark, and the University of Durham, UK. He obtained his MSc degree from UACEG, Sofia, Bulgaria, and PhD degree in mechanical engineering from the Technical University of Denmark. His research focuses on large-scale inverse problems, like shape and topology optimization of mechanical and multi physical system and design of materials including manufacturing and exploitation uncertainties, high-performance computing and wave propagation problems.