Pareto-Optimal Topologies: Theory and Algorithms

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University of Wisconsin, Madison
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2004 Black

Abstract:
The focus of this talk is on efficient multi-objective topology optimization, where one seeks the set of all pareto-optimal topologies that represent a compromise between conflicting objectives. Such topologies are of significant importance in engineering. The methodology that I will present for generating such pareto-optimal topologies relies on the theory of topological sensitivity. The latter captures the first order impact of topological modifications on the behavior of a structure. Exploiting this concept, a necessary condition for a topology to be pareto-optimal will be established. This will naturally lead to a pareto-tracing algorithm that efficiently generates a sequence of optimal topologies.

As a final part of my talk, I will discuss an implementation of the pareto-tracing algorithm on multi-core CPUs and graphics programmable units (GPUs) for large-scale topology optimization. As an example, the bridge on the left below was synthesized using a finite element model with 80,000 degrees of freedom in about 2 minutes on the GPU; on the right is the Oregon City Bridge spanning the Willamette River.

Biography:

Krishnan Suresh is currently an Associate Professor in the Department of Mechanical Engineering Department, University of Wisconsin, Madison. He graduated in 1998 from Cornell with a Ph.D. in Mechanical Engineering. He later served as an Engineering Manager at Kulicke and Soffa Industries, Philadelphia from 1998 through 2002. His research interests are in representational and computational challenges underlying computational and bio-mechanics. He has received numerous peer-reviewed grants, including the prestigious NSF Career award in 2007. He has co-authored over 25 journal papers, and several conference papers, two of which have received best-paper awards from ASME.

This seminar counts towards the ME 600 seminar requirement for Mechanical Engineering graduate students.