NJIT New Jersey Institute of Technology

BME

Department of Biomedical Engineering

Graduate Seminar

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# Subject: Black-Box Finite Element Analysis

## Abstract:

The numerical solution of partial differential equations (PDE) is ubiquitous in computer graphics and engineering applications, ranging from the computation of surface parametrizations, to the simulation of elastic deformations, fluid flows, and light scattering. Ideally, a PDE solver should be a “black box”: the user provides as input the domain boundary, boundary conditions, and the governing equations, and the code returns an evaluator that can compute the value of the solution at any point of the input domain. This is surprisingly far from being the case for all existing open-source or commercial software, despite the research efforts in this direction and the large academic and industrial interest. To a large extent, this is due to treating meshing and FEM basis construction as two disjoint problems.

I will present an integrated pipeline, considering meshing and element design as a single challenge that makes the tradeoff between mesh quality and element complexity/cost local, instead of making an a priori decision for the whole pipeline. I will demonstrate that tackling the two problems jointly offers many advantages, and that a fully black-box meshing and analysis solution is already possible for heat transfer and elasticity problems.

## Date and time: September 25th, 2020 11:30 AM

**WebEx Link:** https://njit.webex.com/njit/k2/j.php?MTID=tf1f53b8cd2154863ed9cb3e01a2254d8