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Department of Computer Science

Black-Box Finite Element Analysis

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Hosted by Przemyslaw Musialski

Date: Wednesday, March 30, 2022
Coffee: 2:15 PM – 2:30 PM
Time: 2:30 PM – 3:30 PM
Location: GITC 4402 (4th floor Seminar Hall)
WebEx Link: **https://njit.webex.com/njit/j.php?MTID=m85b5ecc271955c5c09b52ee86908796e**

https://cs.njit.edu/seminars

Abstract:
The numerical solution of partial differential equations (PDE) is ubiquitous in scientific computing, computer graphics, and engineering. 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 with contact.

Bio:
Daniele Panozzo is an Associate Professor of Computer Science at the Courant Institute of Mathematical Sciences in New York University. Prior to joining NYU, he was a postdoctoral researcher at ETH Zurich (2012-2015). Daniele earned his Ph.D. in Computer Science from the University of Genova (2012) and his doctoral thesis received the EUROGRAPHICS Award for Best Ph.D. Thesis (2013). He received the EUROGRAPHICS Young Researcher Award in 2015, the NSF CAREER Award in 2017, and a Sloan Research Fellowship in 2020. Daniele's research group is leading the development of libigl (https://github.com/libigl/libigl), an award-winning (EUROGRAPHICS Symposium of Geometry Processing Software Award, 2015) open-source geometry processing library, polyfem (https://polyfem.github.io), a simple C++ and Python finite element library, and wild meshing (https://github.com/wildmeshing), a 2D and 3D robust meshing library. Daniele initiated the Graphics Replicability Stamp (http://www.replicabilitystamp.org), which is an initiative to promote reproducibility of research results and to allow scientists and practitioners to immediately benefit from state-of-the-art research results. His research interests are in scientific computing, geometry processing, and geometric deep learning.