

October 17, 2025

Analysis and Optimization of Extruded Thin-Walled Beams



Haim Waisman

*Professor &
Chairman, Columbia
University*

Seminar Details

*Friday, Oct 17, 2025
2:30pm – 4:00pm*

*UH Campus
Classroom & Business
Building
Room CBB 104*

*Online via Teams [https://
www.cive.uh.edu/
research/beyer-
distinguished-lecture](https://www.cive.uh.edu/research/beyer-distinguished-lecture)*

ABSTRACT: Thin-walled beams are widely used in engineering due to their favorable stiffness-to-volume ratio, but they are also prone to complex mechanics such as buckling, warping, and fracture. Modeling these structures efficiently and designing their optimal behavior remains an open challenge in computational mechanics. In this seminar, I will present a new topology optimization framework for designing thin-walled beams manufactured by extrusion. We propose an extended/generalized finite element method (X/GFEM) with global enrichment functions to overcome limitations of costly traditional 3D finite element models. We consider vibration and buckling modes, including corresponding higher-order modes to model displacements, as well as local discontinuous functions to model fracture. The goal is to minimize beam weight while satisfying displacement, stress, and buckling constraints. A density- and gradient- based optimization method is employed, with critical buckling loads computed through the eigenvalues of a linearized buckling problem. Sensitivity analysis is derived using the adjoint method. Case studies demonstrate the effectiveness and potential of the approach.

BIOGRAPHY: Haim Waisman is a Professor and Chair of the Department of Civil Engineering and Engineering Mechanics at Columbia University. His research interests lie in computational mechanics, where he develops advanced finite element methods for modeling fracture and damage in materials, as well as novel design-optimization approaches for structures subjected to extreme conditions.

Dr. Waisman earned his B.Sc. and M.Sc. degrees in Aerospace Engineering from the Technion — Israel Institute of Technology, and his Ph.D. in Civil Engineering from Rensselaer Polytechnic Institute (RPI) in 2005. He was a postdoctoral fellow at the Scientific Computing Research Center (SCOREC) at RPI and in the Department of Mechanical Engineering at Northwestern University before joining Columbia University in 2008.

Dr. Waisman is the recipient of the 2012 DOE Early Career Award, the 2014 Leonardo Da Vinci Award from the Engineering Mechanics Institute (EMI) of ASCE, and several best paper awards. In 2022, he was elected Fellow of the ASCE Engineering Mechanics Institute, and was recently in 2025 named Fellow of the United States Association for Computational Mechanics (USACM). He currently serves as an Associate Editor of the ASCE Journal of Engineering Mechanics and is on the editorial board of Computer Methods in Applied Mechanics and Engineering, among other journals. Previously, Dr. Waisman served as Chair of the ASCE-EMI Computational Mechanics Committee and was a member of the Executive Board of the US Association for Computational Mechanics.