



GTIIT MECHANICAL ENGINEERING SEMINAR

Wednesday, December 17, 2025, at 13:00

Online: <https://technion.zoom.us/j/91595015935>

Variational approaches to fracture: crack nucleation in linear elasticity and fracture in nearly incompressible hyperelasticity

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Hosted by: Prof. Pinhas Bar-Yoseph

Fracture—how and why materials break—remains one of the most challenging problems in solid mechanics. Modeling both crack nucleation under multiaxial loading and contact phenomena—closure, sliding, and friction—within a single variational phase-field framework has long been difficult. Existing phase-field models typically treat either nucleation or contact, while nearly incompressible soft materials, such as elastomers and hydrogels, introduce additional challenges due to volumetric locking and suppressed crack opening in smeared models.

In this seminar, I present new mathematical and computational advances that (i) unify multiaxial crack nucleation and contact behavior within a single variational framework, and (ii) enable predictive three-dimensional simulations of large-deformation fracture in nearly incompressible hyperelastic materials. I also reveal a surprising finding: in certain anisotropic materials, a single load can produce multiple energetically admissible crack paths, with the observed path selected by tiny imperfections—providing the first numerical validation of a local energetic principle governing crack-path selection.

Dr. Bin Li is an Assistant Professor of Mechanical Engineering (and Robotics) at the Guangdong Technion-Israel Institute of Technology (GTIIT) since September 2020. His research lies at the intersection of theoretical and computational solid mechanics, with a core focus on developing mathematical models and advanced computational tools to advance the understanding of material fracture. Dr. Li received his Ph.D. in Applied Mathematics from Universitat Politècnica de Catalunya in 2016. He then pursued postdoctoral training, first at Université Pierre et Marie Curie and later at Cornell University. His current research at GTIIT is dedicated to the fundamental study of damage and fracture mechanisms in diverse material systems, including heterogeneous and anisotropic solids, thin structures, and soft materials. and the reviewer for NSFC.

Seminars Coordinator: Prof. Sefi Givli

Note: the seminar will be given in English