



Professor Nadia Lapusta

Professor of Mechanical Engineering and Geophysics
California Institute of Technology



“Mechanics of earthquakes: extreme localization, frictional instability, and fluid effects”

Abstract: Many seismological studies interpret earthquake sources as shear cracks and use concepts of fracture mechanics to shed light on earthquake source processes. This approach is partially justified by extreme localization of shear deformation on mature faults in the earth’s crust, with kilometers of relative plate motion sometimes accommodated by millimeter-wide layers filled with micrometer-sized rock particles. Classical fracture mechanics models, with cohesive-zone-like failure laws, are used to determine the average shear stress change due to an earthquake rupture and to estimate its fracture energy, i. e., the part of dissipated energy relevant to earthquake rupture dynamics. At the same time, laboratory studies have determined that more sophisticated laws govern shear resistance during earthquakes, including so-called rate-and-state friction and a number of additional dynamic weakening processes due to shear heating and the presence of pore fluids. We will report on recent progress in using the laboratory-derived laws for numerical elastodynamic simulations of earthquake source processes and the associated insights, including similarities and differences with the traditional fracture mechanics interpretations.

Biography: Nadia Lapusta received her undergraduate degree (Diploma with Highest Honors) in Mechanics and Applied Mathematics from Taras Shevchenko National University of Kyiv in Ukraine. She continued her education at Harvard University, receiving her S.M. and Ph.D. degrees in Engineering Sciences in 1996 and 2001, respectively. Since 2002, she has been a faculty at the California Institute of Technology, most recently as Professor of Mechanical Engineering and Geophysics. She is a co-Director of the NSF I-UCRC Center on Geomechanics and Mitigation of Geohazards (GMG) at Caltech and a Leader of the Fault and Rock Mechanics at the Southern California Earthquake Center (SCEC). Professor Lapusta's interdisciplinary research group works in the areas of computational mechanics of geomaterials, earthquake source processes, fundamentals of friction and fracture, and solid-fluid interactions.

Friday, October 11, 2019
11:00-11:50
1106 Mechanical Engineering

Midwest Mechanics Seminar Series

All those interested in any aspect of mechanics including dynamics, fluids, and solids are invited.

<http://mechanics.wisc.edu/>