The Department of Mechanical Engineering/College of Engineering and Applied Sciences
Stony Brook University

Mechanical Engineering Seminar

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Lecture Title: Modelling Size Effects and Dislocation Climb in Single Crystals with Discrete Dislocation Dynamics and Strain-Gradient Plasticity Theories

Friday, July 2, 2010, 11 AM, Room 173 Light Engineering

Abstract

In this talk, we employ discrete dislocation (DD) models and strain-gradient plasticity theories to investigate size effects in plasticity and creep at micron scales. The talk will be divided in two main sections. In the first part, we investigate the role of interfaces in the elastic-plastic response of a sheared single crystal making use of discrete dislocation dynamics and strain-gradient crystal plasticity theories. More specifically, the upper and lower faces of a single crystal are bonded to rigid adherends via interfaces of finite thickness. The sandwich system is subjected to simple shear, and the effect of the compliance of crystal layer and of interfaces upon the overall response are explored. In the second part of the talk, we propose a novel DD framework that is able to handle dislocation glide and climb. The dislocations are free to move at any point in space via the evaluation of the Peach-Koehler force. The model is applied to two-dimensional problems such as pure bending and uniaxial tension of thin films. Preliminary calculations show that dislocation climb relaxes the stress fields in the crystal leading to smaller size effects in tension and change of the deformation mechanism in bending. A parametric study to understand these effects is reported.

Biography

Kostas Danas has been at École Polytechnique (Paris, France) since 2009, when he joined the Laboratory of Mechanics of Solids as a CNRS research scientist. For his doctoral studies, he attended the École Polytechnique and University of Pennsylvania, from where he received Ph.D. degrees in Mechanics of Solids in 2008. Then, he moved to the University of Cambridge, Department of Engineering for a year as postdoctoral research associate before joining École Polytechnique. His current work focuses on the modelling of micron-size crystalline materials using discrete dislocation dynamics and strain gradient plasticity theories. Other areas of research involve the modelling of magneto-rheological elastomers via numerical and analytical techniques as well as the study of the fracture of elasto-(visco) plastic porous metals via nonlinear homogenization theories.

Directions: Please call Augusta Kuhn at 631-632-8310 for more information.

Refreshments will be served

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