Department of Civil Engineering and Engineering Mechanics

Columbia University

Role of microstructure in multiscale crystal plasticity

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One of the underlying principles of materials science is that a material's properties can be deduced from the knowledge of its microstructural features. In particular, the sizes, shapes, orientations and connectivity of internal features are often critical in controlling a material's response to deformation. However, many current approaches to simulating a material's mechanical response lack this ability to adequately address so many factors at once and in a self contained manner.

In this presentation, I will concentrate on two key aspects of this problem. First I will present a dislocation-based constitutive model for the deformation of FCC metals in which the effects of the microstructure and its associated length scales are captured by a non-local crystal plasticity formulation. This approach can naturally account for the influence of both the microstructure and grain size and is validated against experimental data. Second I will assess the role of microstructure's morphology on material's plastici-ty (for both fatigue and monotonic loading) by examining and comparing various micro-structures both at the macroscopic scale and at the microscopic scale (subgrain level). This survey enables to ascertain the fidelity and sensitivity of the numerical model to the microstructural representation.

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2:30 - 4:00 p.m.
Room 627, Mudd

`http://www.civil.columbia.edu/~ling/seminar`