

~ SEMINAR ~

“*Coupling Discrete Dislocation to Continuum Plasticity*”

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Abstract: Plastic deformation in crystalline solids mainly occurs by the nucleation and glide of a large number of discrete dislocations. An approach to solving boundary value problems has been developed where the motion of discrete dislocation is accounted for explicitly. This approach has given qualitative, and in some cases, quantitative agreement with experimental observations on a variety of micron scale plasticity phenomena. However, a significant limitation of such a discrete dislocation approach is the computing time required. I will describe a multi-scale approach where the region in which the discreteness of dislocations is accounted for is limited and the remainder of the body analyzed is modeled in terms of conventional continuum crystal plasticity. Thus, for example, discrete dislocation plasticity can be accounted for in the vicinity of a crack tip while continuum plasticity is used in the remainder of the plastic zone. The key to this approach is the treatment of the interface between the discrete dislocation plasticity and continuum plasticity regions. The interface formulation used will be described and example problem solutions presented.

Bio: Alan Needleman completed his Ph.D. in Engineering at Harvard University in 1970. He then spent five years in Applied Mathematics at MIT before moving to Brown University where he is now Florence Pirce Grant University Professor and Professor of Engineering. His contributions include the development of a ductile fracture computational methodology, the development of cohesive surface methods for fracture analysis and creation of a framework that enables using discrete dislocation plasticity to solve general boundary value problems. Professor Needleman was awarded a Guggenheim Fellowship in 1977, is a member of the National Academy of Engineering and of the American Academy of Arts and Sciences. He has been awarded the Prager Medal by the Society of Engineering Science, the Drucker Medal by the American Society of Mechanical Engineers and has been recognized by ISI as a Highly Cited Author in both the fields of Engineering and Materials Science. Professor Needleman also holds honorary doctorates from The Technical University of Denmark and Ecole Normale Superior de Cachan (France).