

Computational techniques for the design of polycrystalline materials¹

Professor Nicholas Zabaras
Materials Process Design and Control Laboratory
Sibley School of Mechanical and Aerospace Engineering
188 Frank H. T. Rhodes Hall
Cornell University
Ithaca, NY 14853-3801

E-mail: zabaras@cornell.edu
URL: <http://mpdc.mae.cornell.edu/>

We will briefly review our laboratory's approach to materials design problems by integrating microstructural models with virtual databases and statistical learning tools. In particular, we will discuss the (1) Development of innovative computational techniques for microstructure interrogation and multi-scaling of micro-scale deformation and failure, (2) Development of hierarchical microstructure libraries of microstructural signatures (crystal orientations and grain size distributions) with associations to properties (such as strength, toughness and formability) using statistical learning algorithms, (3) Design techniques for identification of the best set of initial features in the microstructure in particular applications, (4) Statistical tools for real-time selection of thermo-mechanical processing sequences to customize microstructures for achieving desired property distributions, and (5) Performing multi-scale finite element analysis for testing and experimentally verifying microstructure design solutions in complex engineering applications.

¹ Invited seminar at the United Technologies Research Center, East Hartford, CT, August 8th, 2008 (Dr. Tahany El-Wardany, host).