



EMERGING TRENDS IN APPLIED MATHEMATICS AND MECHANICS

Mechanics of Materials with Microstructural Defects : Approaches and Related Problems

Organized by

Sanda Cleja-Tigoiu

University of Bucharest, Romania

The **aims of the mini symposium** are

(1) to bring together the various approaches to describe the behaviour of elasto-plastic materials accounting for the microstructural defects, such as dislocations, disclinations, point defects, voids microcracks, interfaces and grain boundaries, respectively, and to emphasize the influence of the heterogeneities,

(2) to analyze the predictions at the macroscopic level of the elaborated models, as they follow from the appropriate boundary value problems.

Approaches: The macroscopic plastically irreversible properties, deformation and strength of crystalline materials are generated and developed by the behaviour of their microstructural defects. The major difficulty in developing a continuum theory of crystal plasticity based on dislocation/disclination mechanism is the multiplicity and complexity of the defect motion and interactions. The continuum models involve evolution equations for measures of defect densities, describe influence of heterogeneities, role of grain boundaries, that ought to be connected with physical principles, say for instance the second principle of thermodynamics restricted to the isothermic processes. The discrete dislocation dynamics have been motivated by the experimental investigation of crystals at sub-micron scales and intend to describe the influence of dislocation evolutions on the crystal behaviour. To bridge the gap between dislocation physics and continuum crystal plasticity the so-called discrete-continuous models have been developed.

Related problems: the definitions of structural defects based on the differential geometry concepts or on the atomistic basis; the interaction between phase transformation and dislocations at nano-scale; the energetic arguments, like balance equations for macro and micro forces, principle of the free energy imbalance, which are related to high order deformations and/or stresses, and so on.