UNIVERSITY OF CENTRAL FLORIDA

MECHANICAL AND AEROSPACE ENGINEERING

Announcing MAE Spring 2013 Seminar Series

Friday, March 22, 2013, 2:00pm-3:00pm, CL 1, Room 320

This event is hosted by the College of Engineering and Computer Science and the Mechanical and Aerospace Engineering Department at the University of Central Florida

"On Yielding of Porous Low-Symmetry Metallic Materials"

Date:
Friday, 03/22/2013

Time:
2:00pm—3:00pm

Location:
CL 1, Room 320

For more information please contact:

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Abstract - Low symmetry metallic materials (e.g. titanium, zirconium, etc.) display deformation and failure properties that are quite different from that of typical materials with cubic crystalline structure (aluminium, steels, etc). Rolled or extruded products exhibit a strong anisotropy and very pronounced difference in yielding and work-hardening evolution between tension and compression loadings. In this talk, new multi-scale models for description of the deformation of such materials are presented. These models are based on a detailed multi-scale characterization conducted in order to identify the physical mechanisms at the single crystal level and their effects on the macroscopic response. The effect of texture evolution is explicitly modeled using these experimental data and numerical tests results performed with a crystal plasticity model. Applications of these models to the simulation of the quasi-static and dynamic response of titanium and zirconium are presented. We conclude with the presentation of a new criterion for porous materials containing spherical voids randomly distributed in a matrix displaying tension-compression asymmetry. The corresponding yield surfaces do not display the usual symmetry properties with respect to the deviatoric axis (i.e. the predicted yield strength under hydrostatic tension is different from the yield strength under hydrostatic compression); furthermore its strong sensitivity to the third invariant of stress deviator is associated to the particularities of the plastic deformation mechanisms (dependence on the sign of the critical resolved shear stress). Furthermore, it is shown that if the matrix tensile strength is higher than its compressive strength, void growth is faster than in materials obeying Gurson's criterion. On the other hand, for certain porous polycrystals in which the matrix tensile strength is lower than its compressive strength, void growth rate is much slower. For uniaxial loading conditions, damage distribution is significantly different in the latter materials; the location of the zone of maximum porosity shifts from the center of the specimen outwards.

Bio - Oana Cazacu graduated from University of Bucharest (Romania) and obtained a doctoral and Habilitation degree from University of Lille (France) in 1995 and 2004, respectively. She is currently Professor in the Dept of Mechanical and Aerospace Engineering of the University of Florida. Her main research interests lie in theoretical and computational solid mechanics with focus on multi-scale modeling of plasticity and damage in textured metals (development of anisotropic yield criteria; anisotropic hardening; damage in heterogeneous materials). She has over 100 referred journal and conference articles and 10 book chapters (edited 3 books) to her credit. She has been successful in securing research funds as principal investigator from the National Science Foundation, the Department of Defense, the Air Force Office of Scientific Research, and major companies such as ALCOA and General Motors. She served as Chairperson for the IUTAM 2011 Topical Symposium on Linking Scales in Computation.