UNIVERSITY of HOUSTON

CULLEN COLLEGE of ENGINEERING

Department of Civil & Environmental Engineering

CIVE 6111 Graduate Seminar Series

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Microfracture Processes Triggering Shear Band Bifurcation in Porous Crystalline Rocks

Friday, September 18, 2015
2:30pm-4:00pm
Room: 102D

Presentation

In this seminar, I will present a computational framework for capturing the microfracture processes triggering shear band bifurcation in porous crystalline rocks. The framework consists of computational homogenization on a representative elementary volume (REV) that upscales the pore-scale microfracture processes to the continuum scale. The assumed enhanced strain (AES) finite element approach is used to capture the discontinuous displacement field generated by the microfractures. Homogenization at the continuum scale leads to incremental nonlinearity, in which the overall constitutive tangent tensor varies not only with the stress state but also with the loading direction. Continuum bifurcation detects the formation of a shear band on the REV level; 3D strain probes determine the most critical orientation for shear band bifurcation. I will present some results of numerical simulations focusing on microfracturing at the pore scale with either predominant interface separation or predominant interface contact modes. Results suggest a non-associative overall plastic flow and shear band bifurcation that depends on the microfracture length and the characteristic sliding distance related to microslip weakening.

About the speaker:

Dr. Ronaldo Borja works in theoretical and computational solid mechanics, geomechanics, and geosciences. At Stanford University, he teaches an undergraduate course in geotechnical engineering, a graduate course in mechanics and the finite element method, and two doctoral level courses in computational plasticity and computational poromechanics. His research includes the development of multi-scale discontinuity framework for crack and fracture propagation utilizing the strong discontinuity and extended finite element methods; solution techniques for multi-physical processes such as coupled solid deformation-fluid diffusion in saturated and unsaturated porous media; stabilized finite element methods for solid/fluid interaction and nonlinear contact mechanics; and nanometer-scale characterization of the inelastic deformation and fracture properties of shales. Ronaldo Borja is the author of a textbook entitled *Plasticity Modeling and Computation* published by Springer. He serves as co-editor of two leading journals in his field, the *International Journal for Numerical and Analytical Methods in Geomechanics* and *Acta Geotechnica*..