

“Thermal and Mechanical Behavior of Granular Mixes”

Dr. T. Matthew Evans

Dept of Civil, Construction & Environmental Engineering

North Carolina State University

ABSTRACT

The granular structure of a soil plays a dominant role in the mechanical and thermal response of the soil mass to external loadings. Concepts such as nonlinearity, inelasticity, stress memory, and anisotropy at the laboratory and field scales can be traced directly to material response at the microscale. By developing a better appreciation for the micromechanical processes that govern soil response, it is possible to gain new and robust insight into why soil behaves as it does at the design scale. At some level, all soils are mixtures: agglomerations of particles with varying size, stiffness, shape, and thermal properties. In the current work, the mechanical and thermal behavior of synthetic granular mixtures is studied numerically using the discrete element method (DEM). Through studying the response of these synthetic mixtures, we hope to gain insight into the behavior of real and engineered soils. Three specific cases will be considered: (1) varying grain size distributions; (2) varying mechanical properties; and (3) varying thermal properties. Material response to external stimuli is simulated and mixture microstructures are investigated to infer the grain-scale mechanisms underlying engineering-scale behavior.

BIOGRAPHY

Matt Evans is an Assistant Professor in the Department of Civil, Construction, and Environmental Engineering at North Carolina State University (NCSU). He received Ph.D. and M.S. degrees in Civil (Geotechnical) Engineering from the Georgia Institute of Technology in 2005 and 2002, respectively, a BSCE from the University of New Mexico in 1997, and a B.A. in Physics from the University of Virginia in 1993. Prior to pursuing his graduate degrees, he was a Senior Staff Engineer with GeoSyntec Consultants in Huntington Beach, CA for three years. His research interests include granular mechanics, energy geotechnics, image processing and analysis, soil-continuum interfaces, and the mechanics of partially saturated soils. Matt is the webmaster for the United States Universities Council for Geotechnical Education and Research (USUCGER) and faculty advisor for the NCSU chapter of Engineers Without Borders (EWB). He currently serves as Vice Chair of the ASCE Geo-Institute Soil Properties and Modeling Committee. He received the 2005-2006 George F. Sowers Outstanding Graduate Student Award from Georgia Tech and his graduate students have won multiple student paper competitions and awards for their work.