Modeling of Land Extreme Subsidence

Presenter: Dr. Ruijie (Jerry) Liu, Associate Professor, Department of Mechanical Engineering, UTSA

Abstract: Many beautiful small islands in Galveston, Texas disappeared after the Goose Creek oil field was discovered. Land subsidence in Long Beach, California reaches more than 30 feet after extraction of oil/gas from the Wilmington Oil Field. Land subsidence of Houston, Texas also contributes the serious water flooding brought by Hurricane Harvey. Geologically, land subsidence is induced by reservoir compaction resulting from the extraction of fluids. Physically, following extraction of fluids, fluid pressure in reservoirs drops down and solid skeletons take more load and undergo compressive deformation. Modeling of land subsidence can provide strong support for land management in terms of fluid extraction and prevention of human-made disasters. Biot’s consolidation theory based on coupled fluid flow and geomechanics has been applied to model the land subsidence. However, it is a challenge to model large subsidence of lands due to high nonlinearity of geomaterial models. This talk focuses on the construction of geomaterial cap plasticity models into a general finite element framework. A simulation example will be presented to demonstrate a large subsidence prediction of ground surface induced by oil/gas reservoir compaction.

Bio: Dr. Ruijie (Jerry) Liu obtained his Ph.D. in computational mechanics from The University of Texas at Austin in 2004. He worked as a finite element developer in ANSYS during 2005-2012 and contributed to develop many nonlinear material models such as geomaterial cap plasticity and coupled fluid flow and geomechanics. Before joining UTSA as a faculty, he worked in BP as a reservoir engineer for modeling multiphase flow in porous rock in HPC clusters. His current research is on fracture propagation in porous media and multiphysics modeling.