CEE AT ILLINOIS
Department of Civil and Environmental Engineering

GEOTECHNICAL ENGINEERING STUDENT ORGANIZATION AT UIUC

CEE 595F – Geotechnical Engineering Seminar

Friday, November 22, 2019 | 11:00 AM, Newmark Lab 3310 | open to all CEE

On coupling between mechanical and flow properties of tight rock

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Abstract: Proper characterization of the mechanical and flow properties of the participating rock formations is crucial for successful implementation of subsurface geo-energy projects, including geological carbon storage and enhanced geothermal systems. Porosity and permeability are the two fundamental properties that can be selected to represent the mechanical and flow characteristics, respectively. For low-permeable or "tight" rocks (shales and granites) that usually serve as the confining layers for underground storage operations, a significant change in permeability could occur due to a small change in porosity caused by hydro-mechanical loading. We introduce a method to measure the stress-dependent permeability and poromechanical parameters that allow calculations of porosity evolution due to applied stresses and pore pressures. The porosity-permeability relationship for tight rock is established by adopting a power-law dependence with the exponent in the range of 14-17, thus being significantly larger than that for a porous reservoir rock. Consequently, even small perturbations of porosity could cause orders of magnitude changes in permeability, possessing a risk on the integrity of the tight formations.