SCHOOL OF MECHANICAL & MATERIALS ENGINEERING

GRADUATE SEMINAR SERIES

Macroscale and microscale analysis of deforming saturated porous media: Terzaghi stress principle and the significance of shear and plasticity in hydrostatic compression

Presented by

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Abstract

A porous material is any solid material with holes in it. Examples include bones, soils, rocks, skin, and egg shells. Here we will consider a porous material consisting of an elastic-plastic solid saturated with a fluid, such as a dry rock (where the fluid is air), or bone, or building materials. The goal is to predict stress versus deformation considering different boundary conditions on the fluid. Two approaches have been traditionally used. In material science, a micromechanical approach, in which one assumes the medium is geometrically periodic and an analysis is performed on one cell, is dominant. In geomechanics and bioengineering, a macroscale approach is more often used, as the geometry is not generally known and parameters are estimated using experiments at the macroscale. In this talk we will use both the micromechanical and macroscale approach to explain some experimental results that are not clear from the macroscale equations. Specifically, the governing equation often used at the macroscale is known as the Terzaghi effective stress principle, or its generalization containing a Biot coefficient. These equations are often used in geotechnical engineering and bioengineering, but in many applications the model does not predict well what is observed. A microscale analysis demonstrates a plausible reason for why the Terzaghi effective pressure (without the Biot coefficient) plays such a dominant role.

Biography

Dr. Lynn Schreyer is an Associate Professor in the Department of Mathematics and Statistics at Washington State University. She received a BS in ME from the University of New Mexico, followed by a MS in Mechanical Engineering from Northwestern University, after which she proceeded to get a PhD in Applied Mathematics from Purdue University. She was a post doc in Agronomy at Purdue University, followed by a faculty position in the Department of Mathematical and Statistical Sciences at the University of Colorado Denver before coming to WSU in 2016. Her research has primarily focused on flow/deformation/swelling of porous materials, where she has worked on applications in the fields of hydrology, geomechanics, biology, and drug delivery.

Thursday, March 7, 2019
11:00am to Noon
ETRL room 101

Meet the speaker before the seminar in ETRL room 119, 10:30am to 10:50am. Light refreshments will be served.

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