Seminar:
Energy-Water-Environment Sustainability (EWES)

Emmanuel Detournay
Professor, Member of National Academy of Engineering
University of Minnesota

Spiraled Boreholes: An Expression of 3D Directional Instability of Drilling Systems

Monday, February 25, 12:00 – 1:00 p.m.
1310 Newmark

Abstract: Occurrence of borehole spiraling is predicted by analyzing the delay-differential equations governing the propagation of a borehole. The analytical nature of the propagation equations makes it possible to conduct a systematic stability analysis in terms of a key dimensionless group that controls the directional stability of the drilling system. An application to a field case is discussed, as well as the simulations conducted by integrating the equations of borehole propagation. They illustrate that, for unstable systems, the model predicts spiraled boreholes with a pitch comparable to what is observed in the field. Furthermore, they show that a limit cycle, characterized by bounded magnitude of the oscillations, is attained if a nonlinearity is introduced in the bit response.

Bio: Prof. Detournay is the Theodore W. Bennett Chair in Mining Engineering and Rock Mechanics at the University of Minnesota. He directs a comprehensive research program aimed at developing rigorous reference solutions and robust numerical methods for hydraulic fracturing and drilling mechanics. A major impact of Detournay's work is found in the analysis of poroelastic effects in various geomechanical problems, such as borehole stability, reservoir mechanics, and material characterization. His research in coupled thermo-chemo-hydro-mechanical processes led to the development of a new technique for measuring thermo-hydraulic rock properties in their original location. He is a fellow of American Rock Mechanics Association and received several awards including ASCE Maurice A. Biot Medal, Basic Research Award from U.S. National Committee for Rock Mechanics, and Technical Achievement Award from Dowell-Schlumberger.

Energy-Water-Environment Sustainability (EWES) is an interdisciplinary program in the Department of Civil & Environmental Engineering that prepares students to tackle various grand challenges in engineering.