

Wellbore cooldown facilitates hydraulic fracture initiation from wells in high temperature formations

Guanyi Lu and Yunxing Lu

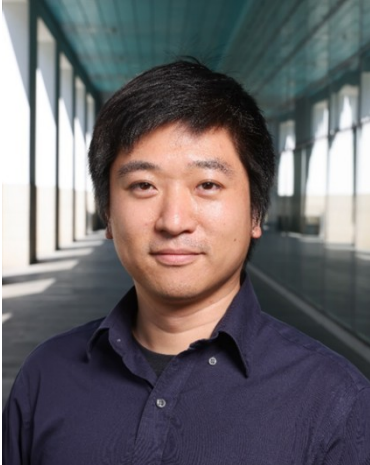
Thursday March 14, 2024, 9 a.m. Central Time

Prof. Guanyi Lu and Dr. Yunxing Lu, from the University of Pittsburgh, will speak on Thursday, March 14, 2024. The topic is “Wellbore cooldown facilitates hydraulic fracture initiation from wells in high temperature formations.”

Abstract

Wellbore cooldown is often employed before well stimulation in Enhanced Geothermal Systems and high temperature petroleum reservoirs to prevent equipment overheating due to high temperatures. The thermo-elastic stress resulting from the cooling activity can significantly influence the behavior of subsequent hydraulic fracturing initiation and propagation. In this talk, we showcase the thermo-elastic effect associated with pre-injection wellbore cooldown through numerical simulations and laboratory experiments. Our results demonstrate that cooling circulation leads to earlier fracture initiation and lower breakdown pressure. Extensive wellbore cooling also promotes the transverse initiation of hydraulic fractures in situations where the initiation would otherwise be longitudinal. These findings highlight the potential for cooling to aid hydraulic fracture initiation and early growth along the favorable direction, and therefore needs to be considered in the planning of reservoir stimulation and the interpretation of in-situ stress testing when cooling operations are necessary.

Biographies



Guanyi Lu is a Visiting Assistant Professor in the Department of Civil and Environmental Engineering of the University of Pittsburgh. His research is centered on exploring the influence of intrinsic rock characteristics - such as anisotropy, time dependence, and thermo-poro-mechanical coupling - on the processes of hydraulic fracturing and fault slip. Guanyi received his PhD degree in Civil Engineering from the University of Pittsburgh and his BS in Civil Engineering from Tongji University. Previously, he worked at the Swiss Federal Institute of Technology Lausanne (EPFL) as a research scientist.



Yunxing (Aaron) Lu is a postdoctoral researcher at the University of Pittsburgh, where he obtained his M.S. from Texas A&M in 2017 and Ph.D. from Pitt in 2022. Aaron is committed to advancing sustainability by developing safer and more reliable renewable energy geomechanics solutions, innovating more resilient geomaterials for extreme conditions, and harnessing the power of advanced AI, including large language models and natural language processing, to analyze and interpret extensive public energy and environmental data, aiming to foster smarter, more efficient sustainability practices.