Modeling of fracture initiation and propagation at Utah FORGE

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Branko Damjanac is a principal engineer at Itasca Consulting Group. The topic is "*Modeling of fracture initiation and propagation at Utah FORGE*". His seminar will take place at 9:00 a.m. Central Time on Thursday, September 4, 2025.

Abstract

The 2024 hydraulic stimulation campaign at the Utah FORGE site aimed to enhance connectivity and increase permeability between the injection and production wells by creating hydraulic fractures and stimulating pre-existing fractures in a naturally fractured geothermal reservoir. While field data confirmed successful interwell connectivity, the influence of natural fracture networks on near-wellbore tortuosity and reservoir stimulation remains an area of ongoing investigation.

The results of a coupled hydro-mechanical numerical analysis of reservoir stimulation, including fracture initiation in the near-wellbore environment and propagation on the reservoir scale, using lattice-based software, will be presented. The different time and length scales are modeled separately. The models incorporate a stochastically generated discrete fracture network (DFN), refined using microseismic data. The near-wellbore model explicitly represents the well casing, cement sheath, and 36 perforation tunnels. To calibrate the models,

simulated pressure trends, fracture propagation patterns and microseismicity are compared with field data, including bottomhole pressure, distributed fiber optic measurements and recorded microseismic data.

The analyses capture key short- and long-term pressure responses. Complex near-wellbore fracture evolution patterns are revealed, consistent with laboratory observations of fracture geometry from a cemented, deviated wellbore. The predicted spatial distribution of fracture growth is consistent with the optical fiber measurements, indicating distinct westward-inclined corridors of fracture propagation. These corridors reflect the influence of natural fractures that hinder the formation of vertical planar hydraulic fractures.

Biography

Branko Damjanac is a principal engineer at Itasca Consulting Group. He earned a Ph.D. in Civil Engineering from the University of Minnesota. His expertise is in geomechanics and modeling coupled processes in geomaterials. For over 35 years, he has provided consulting services to various industries, including mining, nuclear waste disposal, petroleum, civil, and geothermal, to solve problems and optimize designs and operations. For example, he was a member or lead teams studying the mechanical effects of underground nuclear explosions, long-term geomechanical performance of excavations for nuclear waste disposal, stability of underground and open-pit mines, and hydraulic fracturing for petroleum, geothermal and mining applications.