Heart-shape to Fracture Distance: Characterizing Hydraulic Fracture Propagation Before Hits

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Dr. Ge Jin is an Associate Professor of Geophysics and Co-director of the Reservoir Characterization Project at Colorado School of Mines (Mines). He will speak on Thursday, August 8, 2024, at 9:00 a.m. Central time. The topic is “Heart-shape to Fracture Distance: Characterizing Hydraulic Fracture Propagation Before Hits.”

Abstract

Estimating the distance from hydraulic fracture tip to monitor well can be very useful for fracture characterization, well spacing optimization, and preventing parent-child well interference. Heart-shape signal is referred to as the extensional precursor of fracture hit recorded by cross-well strain measurements and can be served as a vital tool to make such estimation. This study incorporates the 3D Displacement Discontinuity Method to understand the impact of fracture geometry and monitor well offset on the heart-shape signal’s characteristics. Results from numerical simulation and analytical solutions reveal a strong linear correlation between the spatial extent of heart shape signal and fracture tip distance. This relationship was further developed to predict tip distance using field data from the Hydraulic Fracture Test Site 2. A reasonable approximation result from field data further validates the methodology. In addition, it is worth noting that the estimation accuracy depends on the ratio between fracture dimension and tip distance. The findings of this study offer a novel approach for real-time monitoring and characterizing hydraulic fracture propagation, which can be further used for well spacing optimization in unconventional and Enhanced Geothermal System reservoir development, as well as cap rock integrity monitoring for carbon sequestration projects.

Biography

Dr. Ge Jin is an Associate Professor of Geophysics and Co-director of the Reservoir Characterization Project at Colorado School of Mines (Mines). He is interested in Distributed Fiber-Optic Sensing (DFOS) applications in geophysics, as well as seismic imaging and machine learning applications. He initiated and developed several important DFOS applications for oil and gas applications, including cross-well strain monitoring, DAS-based microseismic imaging, DFOS-based production logging and reservoir characterization. Before joining Mines, he worked as a research geophysicist at ConocoPhillips for 5 years. Dr. Jin obtained his Ph.D. in Geophysics from Columbia University in the City of New York, and dual B.S. in Geophysics and Computer Science from Peking University.