ARMA Future Leader Webinar Series

Every Two Weeks on Fridays 9-10 am MT (11 am – 12 pm ET)

Quantitative Interpretation of Low-Frequency Distributed Acoustic Sensing Data for End-to-End Hydraulic Fracture Monitoring

Yongzan Liu

Schlumberger-Doll Research

Friday, July 26, 2024, 9-10 am MT (11 am – 12 pm ET)

https://stonybrook.zoom.us/j/9539339965?omn=96069259795

Abstract

Low-frequency distributed acoustic sensing (LF-DAS) has become an increasingly popular method for monitoring hydraulic fracturing operations, because the cross-well strain and strain-rate responses obtained through LF-DAS can provide valuable information on the fracture-propagation process and evolving fracture geometry. Moreover, LF-DAS measurements exhibit different sensitivities before and after fracture hit. To fully realize the potential of LF-DAS for hydraulic fracture monitoring and characterization, we developed two quantitative interpretation workflows based on the data sensitivity: one for LF-DAS data before the fracture hit, which focuses on the fracture advancement; and another for data obtained after the fracture hit, which focuses on the width and height of an equivalent fracture around the monitoring well(s).

To validate the accuracy of the inversion algorithms, we tested them using a synthetic case with known reference solutions. We then applied the workflows to a field case from the Delaware Basin (HFTS2). Our analysis of the inversion results revealed that the fracture propagates continuously in the beginning followed by an intermittent pattern, as evidenced by the fracture half-length evolution. After the fracture hit, the fracture width increases from about 0.5 mm to about 0.9 mm during the pumping stage and gradually decreases during the shut-in period. The fracture height changes during the pumping stage and stabilizes at about 150 m during the shut-in period, the trend of which is consistent with the LF-DAS signals acquired from the offset vertical monitoring well.

The findings from this unique field data could provide novel insights on the characteristics of fracture geometry and significantly improve the understanding of complex fracture propagation processes in subsurface reservoirs.

SLB-
Private

Biography

Dr. Yongzan Liu is currently a senior research scientist at Schlumberger-Doll Research, located in Cambridge, Massachusetts, US. Before joining SLB, he was a postdoctoral research fellow in the Energy Geosciences Division at Lawrence Berkeley National Laboratory. He has been working on various research topics related to energy geomechanics, including coupled thermal-hydraulic-mechanical (THM) modeling of subsurface fractured reservoirs, hydraulic fracture monitoring and characterization, enhanced geothermal systems (EGS), system behaviors of gas hydrate accumulations, geological carbon storage, etc. He is currently interested in the integration of advanced numerical modeling and monitoring techniques to better understand the complex processes in subsurface reservoirs. He has filed three patents, co-authored one book, and published more than 30 technical papers. He holds a Ph.D. degree from Texas A&M University, an MS degree from the University of Alberta, and a BS degree from China University of Petroleum (East China), all in Petroleum Engineering.

SLB-
Private