Geophysical Society of Pittsburgh

Proudly Presents Tuesday, Nov. 7th, 2017
At
Cefalo's Restaurant, Carnegie, PA

Hilbert Transform of the Distributed Acoustic Sensing (DAS) Fiber Optic Data for the Marcellus Shale

Payam Kavousi

West Virginia University

Abstract: Distributed acoustic sensing (DAS) technology utilizes optical fibers to measure the dynamic strain at all points along the fiber. Fiber optic distributed acoustic sensing (DAS) data is recorded for 28 stages in the MIP-3H gas well in Morgantown, WV. We calculated two attributes to evaluate vibration frequencies around the fiber during the stimulation; they are calculated on each of the 493 traces for every 30 seconds during the hydraulic fracture stimulation (one SEGY file for every 30 seconds). The first attribute is the energy attribute: a summation of the squared amplitude of the DAS traces. Secondly, the DAS data are transformed into the Hilbert domain to calculate the instantaneous frequency attribute. Traditionally, the instantaneous frequency attribute of 3D seismic data is calculated for reservoir characterization in order to identify abnormal attenuation and thin bed tuning. It can also be used as a hydrocarbon indicator, since high frequency contents get attenuated faster when encounter fluid. In this study, we show that instantaneous frequency attribute can be calculated for the DAS data to acquire details about vibration around the fiber. We use the instantaneous frequency attribute of the DAS traces during the stimulation to detect abnormal vibration decay. Our result show that instantaneous frequency attribute reveals low frequencies in the stages below and above the stimulated stage. The higher the energy attribute, the lower the instantaneous frequencies. Instantaneous frequency attribute is sensitive to the fluid existence; higher frequencies get attenuated faster than lower frequencies. Thus, higher energy attribute in the DAS data would be associated with high amount of injection fluid around the fiber and within the casing. Local low frequency zones in adjacent stages of the stimulation target might suggest temporary hydraulic connection via faults and fractures during the stimulation. We noticed low frequency zones in Stage 9 while stimulation of Stage 10. These local low frequency zones were also detected in the earlier stages of stimulated Stages 6, 5, 21, and 24. These findings could explain abnormal temperature increase in the distributed temperature sensing (DTS) data for the adjacent stages of the stimulation target.

Biography: Payam Kavousi received his B.S. in Petroleum Engineering (2007) from Petroleum University of Technology in Iran. Then he earned a dual degree M.Sc in Petroleum Engineering and Geophysics (2010) from Petroleum University of Technology in Iran and Institute Francais du Petrole in France, respectively. His PhD research at WVU was focused on reservoir characterization and fluid flow simulation for naturally fractured reservoirs. Afterwards, he started working as a postdoctoral fellow in reservoir engineering and geology at the Marcellus Shale Energy and Environment Laboratory (MSEEL) at WVU. His current research efforts include fiber optic data processing and interpretation, and fluid flow simulation for the MSEEL project.

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Tuesday, November 7th, 2017 Agenda:

5:00 pm Social Hour (Beer and Wine) sponsored by:

Schlumberger

6:00 pm Dinner Buffet

7:00 pm Lecture sponsored by:

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To receive CEU certificate from this lecture please email: emily.mcclain@williams.com

This months lecture will be held at :

Cefalo's
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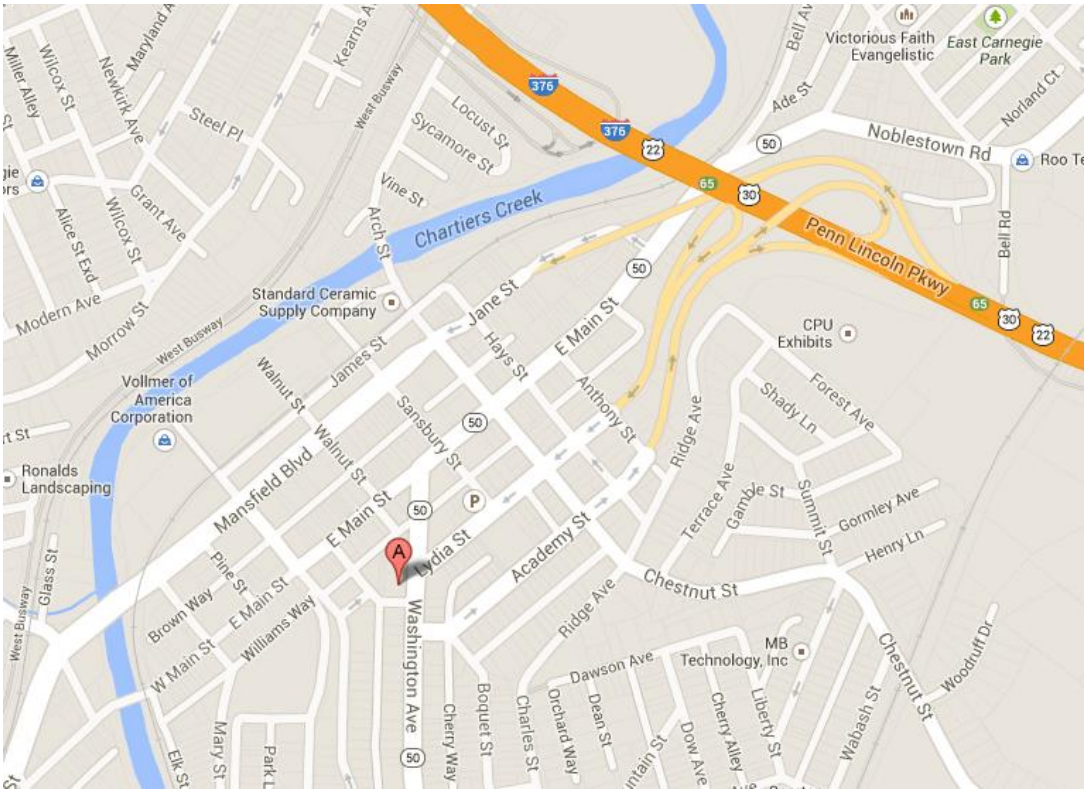

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