Abstract
Over the past decade the shale revolution has driven a dramatic increase in hydraulically stimulated wells. Since 2010, hundreds of thousands of hydraulically fractured stages have been completed on an annual basis in the US alone. It is well known that the geology and geomechanical features vary along a lateral due to landing variations, structural changes, depletion impacts, and intra-well shadowing. The variations along a lateral have the potential to impact the fluid distribution in a multi-cluster stimulation which can impact the drainage pattern and ultimately the economics of the well and unit being exploited. Due to the lack of low-cost, scalable diagnostics capable of monitoring cluster efficiency, most wells are completed using geometric cluster spacing and the same pump schedule across a lateral with known variations.

A breakthrough patent-pending pressure monitoring technique using an offset sealed wellbore as a monitoring source has led to advancements in...
quantifying cluster efficiencies of hydraulic stimulations in real-time. To date, over 1,500 stages have been monitored using the technique. Sealed Wellbore Pressure Monitoring (SWPM) is a low-cost, non-intrusive method used to evaluate and quantify fracture growth rates and fracture driven interactions during a hydraulic stimulation. The measurements can be made with only a surface pressure gauge on a monitor well.

SWPM provides insight into a wide range of fracture characteristics and can be applied to improve the understanding of hydraulic fractures in the following ways:

- Qualitative cluster efficiency/fluid distribution
- Fracture count in the far-field
- Fracture height and fracture half-length
- Depletion identification and mitigation
- Fracture model calibration
- Fracture closure time estimation

The technique has been validated using low frequency Distributed Acoustic Sensing (DAS) strain monitoring, microseismic monitoring, video-based downhole perforation imaging, and production logging. This paper will review multiple SWPM case studies collected from projects performed in the Anadarko Basin (Meramec), Permian Delaware Basin (Wolfcamp), and Permian Delaware Basin (Leonard/Avalon).

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Ewing, T. E. and H. Christensen, 2016, Texas through time: Lone Star geology, landscapes, and resources: The University of Texas at Austin, Bureau of Economic Geology Udden Series No. 6, 431 p.


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