Transforming Video Camera-based Analytics into a Well Performance Indicator

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Thursday September 15, 2022, 9 a.m. Central Time

Souvak Saha, is a Technical Advisor for EV, the downhole visual analytics company. This work also includes contributions from Glyn Roberts, Carl Strubberg, and Joe McDonald. His presentation will be at 9:00 Central Time on Thursday, September 15, 2022. The topic is "*Transforming Video Camera-based Analytics into a Well Performance Indicator.*"

Abstract

Video camera-based perforation analytics in hydraulic fracturing provides the highest resolution fracture diagnostics. It directly provides the condition of perforations which are the main "touchpoints" to the reservoir for proppant placement and eventually production. Without downhole camera, traditionally several assumptions were made about perforations, proppant placement and the effectiveness of stimulation. Now with availability of in-situ images of each perforation and detailed dimensions of their shape, size, location and whether they are open or closed, many of the earlier assumptions are being dispelled. More importantly, detailed analysis of perforations and the computed erosion during proppant placement can be used as practical indicators of well performance.

One such example is the shape of perforations. Based on surface testing perforations were always considered to be circular in shape. The reality, as observed from downhole camera images, is different. With that consideration diameter, the benchmark measure for perforations, has evolved to require three different definitions - average, equivalent and hydraulic diameter - leading to confusion on terminology. Instead, the use of perforation entry hole area is proposed, avoiding this ambiguity, and providing greater accuracy than diameter, especially when the shape of perforation is strongly non-circular. Terminology confusion also leads to inaccuracy in computing perforation friction pressure (ΔP_{perf}). However, the ΔP_{perf} equation can be easily modified to use area in place of diameter.

Perforation entry hole erosion during proppant transport has a significant influence on fracture treatments. This erosional information is now utilized to infer proppant placement and the distribution of proppant within stages. Extending further and utilizing erosion and its measured variability we discuss a new metric to help quantitatively define stimulation effectiveness. This new metric could aid the comparison of stimulation effectiveness between stages and wells, and more excitingly, offer the possibility of a quasi-production log. This new metric we explore is termed "Composite Stimulation Effectiveness or CSE" and is the product of treatment uniformity, coverage, and erosion growth of perforations across a stage.

CSE offers an intuitive understanding and applicability that a stage or well with a higher CSE value has more regular proppant distribution and greater proppant placement. This should be indicative of higher production potential if other parameters (casing/cement/rock) remain consistent. The only caveat is that very high CSE values that result from high erosion growth are observed to be near depletion zones of adjacent wells or fractures (Fracture Driven Interaction or FDI effect). Interestingly, therefore CSE information can be utilized to detect FDI providing an added advantage to its use. In summary, downhole camera analytics extends the possibility of creating a metric to address quantification of stimulation effectiveness and provide an indication of well performance.

Biography

Souvick Saha is working as a Technical Advisor for EV, the downhole visual analytics company. Prior to EV, he worked in Petronas, Schlumberger, and Western Atlas (pre-Baker Hughes), with Schlumberger being the longest. Geographically he worked in Asia Pacific, Middle East, Africa, and North America. He received his Ph.D. in Geology from Texas Tech University and Master's from Indian Institute of Technology.