How Can We Make Best...Better: Using Abaqus and Isight to Optimize Tools for Downhole Expandable Tubulars

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Abstract: The use of expandable tubulars has emerged as a popular technology for drilling and completing wells. While expandable tubulars vary in type depending upon the application and specific well requirements, the most common approach is to actually form the metals downhole, which presents unprecedented challenges for tool designers. The costs and timelines to achieve a "workable" product can be tremendous. The Abaqus and Isight simulators effectively address these impediments and have been proven to be invaluable tools for enhancing understanding of the mechanics and effects of nonlinear/dynamic expansion of metals. In this presentation, the author reviews some of the challenges that had to be overcome in engineering these expandable products. Abaqus has been used to simulate expansion of threaded connections and was instrumental in optimizing the latest expandable thread designs. Meanwhile, Abaqus was used in conjunction with Isight to optimize the geometry of the next generation of expandable cones for the expansion of downhole tubulars. While these applications tested engineering intuition, the two simulation tools cleared the way for the development of an improved approach to downhole expandable tubulars.

Keywords: Optimization, DOE, Expandables, Expandable Tubulars, Oilfield, Expandable Connections

1. The Trial Run

Beginning in December 2008, in-house training on Simulia was followed by a three-month trial of Isight. In February, the Abaqus Isight component was released and first implemented at Baker Hughes. The Abaqus component allows the user to communicate seamlessly with the CAE model behind the scenes. Consequently, it affords the analyst a way to pick the dimensions to change, to either optimize or create a design of experiments (DOE) for the study. If the designer has a SolidWorks model, the analyst can use its associativity in Abaqus and employ Isight to change the model geometry in SolidWorks.

An immediate need arose within the expandables tubular design group to use Isight to optimize tool development. For the past few years, Abaqus has been used in developing expandable products. In the first quarter of 2009, multiple projects simultaneously reached the conceptual stage. With each size of expandable casing, new cone geometries needed to be developed and optimized.

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