Automatically Quantifying Wireline and LWD Pressure-Test Quality

Mark Proett is a Sr. Petroleum Engineering Consultant for Aramco Services Company, Upstream Group in Houston. Mark is best known for his publications advocating the viability of the formation testing-while-drilling (FTWD), introduced in 2002, with the Sperry GeoTap service. He has been awarded 54 US patents and authored over 50 technical papers, most of which deal with sampling and testing analysis methods. He has been an SPWLA Distinguished Speaker and SPE Distinguished Lecturer. In 2008 Mark received the SPWLA Distinguished Technical Achievement Award and in 2013 the SPE Gulf Regional Formation Evaluation Award. Mark has a Bachelor of Science in Mechanical Engineering from the University of Maryland and his Master of Science from Johns Hopkins University.

Abstract

In the literature regarding wireline (WL) and logging-while-drilling (LWD) pressure testing analysis, theoretical transient models are promoted to evaluate the quality of pressure test points, typically by a skilled analyst. However, in practice, other criteria are normally used to judge the test quality. Some are ad hoc, but there is a growing consensus that several convenient, simple, and effective real-time measurements are needed to evaluate the quality of the test points. This presentation demonstrates an automated process that was developed where these real-time measurements are used to determine the validity of the pressure test and a rating assigned based on predetermined standards.

The primary measurements made now include the drawdown mobility (md/cp) and buildup stability (psi/min). Although these measurements can be effective independently, they are also a source of information that can be expanded upon to further analyze the data. For example, how does the pressure stability compare to what is expected considering the drawdown mobility? Noise in the pressure data caused by mud flow is particularly evident in LWD pressure testing and the standard deviation of the pressure data during the buildup is another consideration for test quality. The radius of investigation can be estimated using the drawdown/buildup times with the mobility estimate to quantify the testing effectiveness. Supercharging is a concern for pressure measurements when the pressure measured is influenced by mud filtrate invasion that has elevated the pressure at and near the wellbore. The supercharge potential can be determined by making some simplifying assumptions to further evaluate the data points. These calculations can be made by using basic principles and will guide the analyst monitoring the test to determine the relative quality of the test points. In this way, the best quality test points are used in the analysis of fluid gradients or for integration into the petrophysical analysis.