Advancement in Acoustic Logging Techniques and Applications in Reservoir Characterization

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Sonic measurements have come a long way since their introduction 50 years ago. The latest advancement in sonic technology delivers the highest quality data seen to date, allowing acoustic measurements to characterize mechanical and fluid properties around the borehole and tens of feet into the formation. In their early days, sonic measurements were relatively simple. They began as a way to match seismic signal to rock layers. Today, sonic measurements reveal a multitude of reservoir and wellbore properties. They can be used to infer primary and secondary porosity, permeability, lithology, mineralogy, pore pressure, invasion, anisotropy, fluid type, stress magnitude and direction, the presence and alignment of fractures, and the quality of casing cement bonds. Improvements in sonic measurements are enhancing our ability to determine some of these properties. Accuracy is improving in the basic measurements, which consist of estimates of compressional (P), shear (S), and Stoneley (St) wave slowness. Variations in slowness can now be better characterized, leading to an improved understanding of how formation properties change with distance and direction. Improved characterization of compressional and shear slowness in terms of their radial, azimuthal, and axial variations is now possible with a new sonic technology. High-quality waveforms and advanced processing techniques lead to more accurate slowness estimates, even in unconsolidated sediments and large boreholes, as well as reliable through-casing slowness measurements. These improvements result in better characterization of subsurface rock and fluid properties, meaning more stable wellbores, long lasting completions, and enhanced production.