

## Multiscale Filtering of Acoustic Data to Extract Subsurface Formation Properties

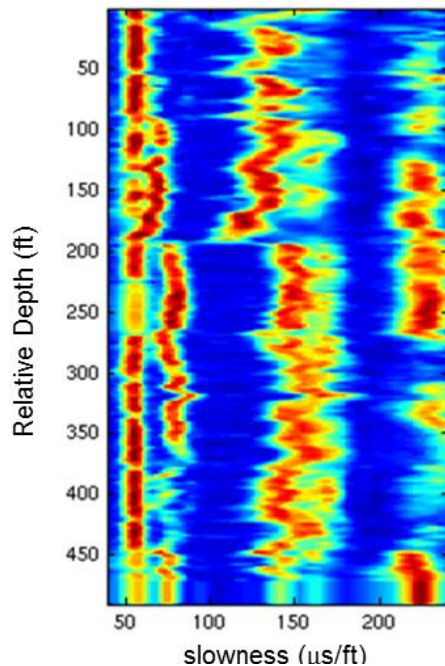
Henry-Pierre Valero<sup>(1)</sup> and Jaideva C. Goswami<sup>(2)</sup>

(1) Schlumberger, 2-2-1 Fuchinobe, Sagamihara, Japan

(2) Schlumberger, 110 Schlumberger Dr., Sugar Land, Texas, U.S.A.

Characterization of a complex medium consisting of a layered earth formation with multiphase fluid is a challenging problem. In applications to oilfield exploration, a wellbore—typically 15 to 30 cm in diameter—is drilled to a depth of a few kilometers. Metal pipes (referred to as “casing”) are installed in the wellbore for well stability. Earth formation and fluid properties (e.g., lithology, porosity, resistivity, fluid composition, saturation) are determined by a host of sensors employing multiple physics for their operation. One of the important measurements is based on acoustic wave propagation in which sonic sources transmit monopole or higher-order waves that interact with the wellbore and the formation. Waveforms recorded by a set of sensors located along the wellbore axis are then processed to invert to determine the desired formation properties.

In this paper, we present a wavelet-based multiscale filtering approach to sonic data that helps remove the extraneous casing signal and improve the parameter



**Figure 1: Wave slowness as a function of relative depth.**

estimation. Figure 1 shows the slowness at different depths derived from waveforms recorded in a cased wellbore. The plot indicates a very coherent and continuous casing arrival near 57- $\mu$ s/ft slowness. This data is challenging to process because the compressional signal propagates at a speed very close to the casing, and the separation of these two events is difficult with standard techniques. This paper describes a method in which an appropriate mask is applied in the wavelet transform domain to remove undesired signal components. An inverse wavelet transform then improves the estimates of formation parameters. Results for synthetic and experimental data are

presented.