

Elastic impedance inversion for enhanced reservoir characterisation

MARK SAMS

Jason Geosystems Asia
101 Thomson Road #11-05
United Square, Singapore 307591

Inversion of seismic data generates an impedance volume. The impedance volume contains all the information in the seismic data and removes the deleterious effects of the wavelet. Impedance, which is an absolute property of the rock layers, is usually related to parameters that characterise the important properties of hydrocarbon reservoirs. Impedance volumes are therefore used as the basis for static and dynamic models of reservoirs. Typically inversion is carried out on stacked seismic data. It is assumed that the stacked seismic data represent a zero offset response and that the output from inversion is acoustic impedance. The acoustic impedance contains information about the rock density and compressional velocity.

These days many more different types of seismic data are becoming available: angle stacked, offset stacked, mode converted and multiple component. All these seismic types can also be inverted to generate impedance. The impedance generated from these seismic data types is elastic impedance. The elastic impedance contains information about the rock density, compressional and shear velocity. These rock properties are the same as those that determine the seismic AVO response. Elastic impedance therefore combines the benefits of AVO analysis and inversion. That is giving quantitative information on the lithology and fluid distribution within the reservoir volume.

In one case study, a far angle stack was inverted for elastic impedance. The elastic impedance was able to delineate a Class II gas sand that would have been missed by acoustic impedance inversion. The elastic impedance allowed rapid gas sand delineation for a variety of sands and volumetric analysis. In a second case study, a mode converted seismic data set was inverted for elastic impedance. The elastic impedance was able to discriminate between good and poor quality reservoir. This was not possible from the acoustic impedance. The elastic impedance allowed rapid reservoir delineation and interpretation of individual sand bodies within the reservoir.

Elastic impedance inversion permits fast, accurate, quantitative analysis of reservoirs enhancing the interpretation from acoustic impedance inversion.