Relative Impedance Inversion of Seismic Traces by Means of Complex Trace Attributes

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ABSTRACT

Complex trace attributes have been used by exploration geophysicists since they were made popular by a paper of Taner and Sheriff in the famous AAPG Memoir 26 (Seismic Stratigraphy, 1977). Envelope, instantaneous phase and frequency commonly served to create alternative displays of seismic data. The results were of limited usefulness because their appearance was hard to interpret beyond some basic rules of thumb. To extend the utility of these complex attributes, we developed an algorithm to transform stacked seismic traces into reflectivity sequences in a recursive procedure. The transformation is accomplished by translating principle attribute sets (envelope amplitude, phase, and frequency picked at envelope peaks) into single layer elements. The resulting reflectivity traces are broad-band filtered, and finally integrated to form relative impedance traces. Panels of these traces resemble geologic cross-sections much more than the original seismic sections, albeit based on a time scale. Provided the input data is of good quality with a stable source wavelet the vertical resolution is drastically improved and thus allows the analysis of fine structural details, which were not recognisable on the original seismic sections. On the same provision the resulting relative impedance variations can be used to identify possible reservoirs. Isolated layers as thin as a few milliseconds two-way travel-time may be resolved, if the noise level of the data is low. Field examples will confirm the quality and accuracy of the described method.