Automation in Seismic Interpretation

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ABSTRACT

3D seismic surveys are primarily used to map subsurface structural features and stratigraphic variations within the reservoir. Lately, 3D seismic surveys were used for fluid changes in a producing reservoir via time-lapse techniques, which use consequent surveys acquired after certain periods of production. This technique, known as 4D, manifested a growing role for the seismic method in reservoir monitoring besides its role in exploration and development. An important aspect of the 3D seismic surveys life is interpretation. Especially for production fields, the goal of is to extend reservoir knowledge from well locations to the full volume of data towards estimating reservoir properties where there are no wells. Some aspects of 3D seismic interpretation can be performed automatically by computers. Two essential interpretation procedures are picking of horizons and faults. We will show that all horizons can be picked automatically via an inversion algorithm without any human intervention. Moreover, we introduce a new method, which processes 3D seismic volumes and generates images of fault likelihood and corresponding fault-plane. Based on these fault attributes, fault surfaces can be tracked automatically. Instead of picking horizons based on amplitudes of seismic cubes, local dips of seismic events are computed and inverted for 3D curved time surfaces; each of these surfaces corresponds to a specific geological deposition time. The inversion will yield thousands of such geological time horizons, unlike the few picked horizons available from manual seismic interpretation. In addition to the inversion of horizons, we have employed a novel edge detection technology to calculate fault-related attributes, including the fault likelihood and fault plane orientations. The new technology can reduce the noise resulting from conventional coherency-based methods. These enhancements are achieved by scanning among all possible fault angles and generating the most likely fault attributes. These tools enable 3D seismic interpretation to be completed in a much reduced cycle time. It also allows interpreters to have a quick overview of the depositional history and fault networks. With this type of automation, human bias is minimized and thus reduction of potential errors when interpreting seismic volumes is readily achieved.