Summary: WIT report 2010

IMAGING

Asgedom et al. propose the use of the MUltiple SIgnal Classification (MUSIC) algorithm as a replacement of semblance to obtain a high-resolution estimation of CRS parameters.

Costa et al. compare the performance of splitting techniques for stable implementations of 3D Fourier Finite-Difference (FFD) migration. Using numerical examples in homogeneous and inhomogeneous media, they show that alternate four-way splitting into the coordinate directions at one depth and the diagonal directions at the next level yields results of the same quality as full four-way splitting at the cost of two-way splitting.

Figueiredo et al. present two approaches to seismic diffraction imaging based on the diffraction operator, which can be used in both the time and depth domains, in accordance with the complexity of the area. The first method makes applies pattern recognition to the amplitudes along the diffraction operator. The second method relies on a statistical analysis of these amplitudes to design a weight function that suppresses noise and reflections and enhances diffraction events.

Garabito et al. present a new procedure of prestack depth migration combining the flexibility of the Kirchhoff migration operator with the CRS stacking method. This procedure is mainly based on CRS ability to collect paraxial amplitudes around a reference trace to be migrated over a Huygens surface and positioning the stacked values in its true depth positions.

Garabito et al. present a stable and fast poststack procedure to interactively estimate the velocity model by means of coherency and focusing analyses of diffraction events simulated from CRS-attributes. They validate this approach by using a synthetic data from a layered model.

Maciel et al. give a short introduction to automatic time migration velocity analysis methods and discuss their parametrization. Numerical examples demonstrate the how the approach works.

Perroud et al. present here the results of CRS reprocessing of a 3D real dataset. The main objective was to evaluate the ability of the methodology to recognize weak vertical-displacement faults. An original strategy was elaborated to define the best possible 3D CRS parameters. The resulting image shows improved event continuity compared to conventional processing, pointing out to a possible fault zone.

Przebindowska et al. present the application of acoustic full waveform tomography to the marine data set from the North Sea. The study discusses some of the problems that concern the field data preprocessing, wavelet estimation, and the choice of different inversion strategies.

Shahsavani and Mann present a model-based approach to the recently introdced Common-Diffraction-Surface (CDS) stack method. The latter has been specifically developed for situations where the Common-Reflection-Surface stack suffers from numerous conflicting dip situations. Originally implemented in a purely data-driven manner, the CDS approach has now also been implemented in a substantially faster model-based manner to obtain stack sections optimized for poststack migration. This approach is well suited for complex data where prestack migration is unapplicable due to difficulties in building a macro-velocity model of sufficient accuracy.

Zhebel et al. present an extension of the localization of seismic events by diffraction stacking to 3D media. Examples for data with a high noise level in homogeneous media are considered as well as heterogeneous media with triplications. Also effects of the double couple radiation pattern were investigated. Furthermore, a field data example from Southern California is presented where the acquisition footprint is compensated by weights based on Voronoj cells.

MODELING

Dell and Gajewski propose a new method for tomographic inversion. The inversion is based on the kinematic wavefield attributes extracted in the time-migrated domain. The method can be seen as an additional tool to provide constraints for kinematic velocity model building. It is particularly useful in areas where diffractions and triplications are located close to reflections generating conflicting dip situations. The method has been successfully tested on a synthetic data example.

Dell and Gajewski present an application of the CRS-based diffraction imaging to synthetic and field data. They also show how the separated diffracted events can be used to build time-migration velocity model.

Kaschwich et al. investigate the impact of diffractions on pre-stack depth migration images and discuss some correlated resolution aspects. Furthermore, we present examples where we apply a ray-based approach to compute synthetic seismograms for both reflected and diffracted events. Finally, we document the applicability of the approach to different model types, e.g. isotropic and anisotropic media.

Tessmer demonstrates that the Rapid Expansion Method (REM) for seismic modelling applied in a time-stepping manner is superior to finite-difference time-stepping. This is important for long propagation times where numerical dispersion might occur. He tests the solutions of REM by comparison with analytic solutions. He also shows how the time derivative of the solution of the wave equation needed, e.g., for the computation of Poynting vectors can be calculated at almost no extra cost.

OTHER TOPICS

Baykulov et al. describe the use of CRS attributes in various modules for reflection seismic data processing. The CRS attribute based modules contribute to multiple suppression, model building, pre-stack data enhancement and depth imaging. The paper demonstrate the interaction of the modules and shows the benefits by combining them in a processing workflow. For example, the prestack data enahncement not only improves the quality of prestack data but also helps to suppress filtering artifacts in multiple removal and allows a better QC of migration velocities.

Dramsch and Gajewski deleted traces from a synthetic data record to interpolate over sparse data and to extrapolate over the end of acquisition. They compare the original traces to the results of the interpolation process using partial CRS stacks. The results are encouraging not just for short offsets but also for intermediate offsets and at the end of the acquisition. This observation concerns arrival times and frequency content of the interpolated traces.

Santos et al. apply the fast extraction of CRS parameters using modern local-slope-extraction techniques to synthetic data from inhomogeneous velocity models. A comparison of the numerical results to a simplified implementation of a conventional CRS procedure demonstrates that the technique lead to meaningful values for the so-determined CRS parameters.

Tygel et al. extend previous expressions for inversion of reflector dip and curvature from CRS coefficients of time-migrated reflections to include (a) A simpler and more direct expression for the reflector curvature and (b) Corresponding expressions for the CRS coefficients for ZO (stacked) reflections. The obtained expressions represent useful constraints for map migration along normal rays or image rays.

Vanelle et al. suggest a new stacking operator for curved subsurface structures. The resulting implicit traveltime expression is derived from evaluating Snell's law at a locally spherical interface. Examples show that the new operator performs well for a wide range of reflector curvatures from nearly planar reflectors to the diffraction limit.