Summary: WIT report 2008

IMAGING

Amazonas et al. apply the complex Padé approximation to the acoustic wave equation for vertical transversely anisotropic (VTI) media to derive a more stable FD and hybrid FFD/FD migration for such media. Synthetic examples demonstrate the improved stability of the complex migration algorithms as compared to their real counterparts.

Amazonas et al. implement SSPSPI and complex Padé FFD migrations using the amplitude corrections determined by the true-amplitude one-way wave equations. They demonstrate the amplitude gain using these amplitude corrections on the synthetic SEG/EAGE salt model.

Anikiev et al. apply a modified diffraction stack for the localization of microtremors in a complex heterogeneous medium. The study shows that stacking is a suitable tool to localize acoustic emissions in strongly heterogeneous media. However, first arrival traveltimes might not be adequate to localize low frequency microtremor data even if the correct velocity model is assumed.

Baykulov and Gajewski performed partial CRS stacking to enhance the quality of sparse low fold seismic data. They describe an algorithm, which allows to generate NMO-uncorrected gathers without the application of inverse NMO/DMO. Gathers obtained by this approach are regularised and have better signal-to-noise ratio compared to original common-midpoint gathers. The method is verified on 2D synthetic data and applied to low fold land data from Northern Germany. Prestack depth migration of the generated partially stacked CRS supergathers produces significantly improved common-image gathers as well as depth migrated section.

Chira-Oliva et al. proposed the fourth-order CRS traveltime expansion as a new alternative for the seismic stacking. The fourth-order CRS operator tested on simple synthetic models provide good stacked sections with a higher S/N. Then, the investigated CRS operator simulates better the ZO sections than the conventional CRS operator within larger offsets.

Dümmong and Gajewski are presenting a continued development of a multiple suppression method using CRS attributes. Multiples are predicted on the CRS stacked section, prediction errors are addressed and prestack seismograms generated with CRS attributes are adaptively subtracted from the original data.

Garabito et al. propose a new method for migrating two-dimensional (2D) multicoverage seismic data to zero-offset section, i.e., Migration to Zero-Offset (MZO). It is based on the Commom Reflection Surface (CRS) stack formulas that are used to approximate the diffraction stack operator, and to produce a demigration of the zero-offset stacked data. This new approach, so called CRS-MZO, is applied to synthetic and real land datasets.

Köhn et al. discuss the first results of elastic full waveform tomography of synthetic multicomponent reflection seismic data. Starting from a long wavelength model for the elastic material parameters the waveform tomography result can resolve details below the seismic wavelength. The influence of different parameterizations and preconditioning operators on the tomography result will be discussed.

Kurzmann et al. investigate the performance of full waveform tomography (FWT) for a transmission and a reflection geometry. Especially the progress of the FWT for a reflection geometry is very sensitive to the starting model. Additionally we show possibilities to increase the performance of our time-domain implemention, such as step length optimization and shot parallelization.

Schleicher et al. show that image-wave propagation in the common-image gather (CIG) domain can be combined with residual-moveout analysis for iterative migration velocity analysis. For this purpose, the CIGs obtained by migration with an inhomogeneous macrovelocity model are continued starting from a constant reference velocity. The interpretation of continued CIGs as obtained from residual migrations leads to a correction formula that translates the residual flattening velocities into absolute time-migration velocities.

Schleicher and Costa demonstrate that information about the migration velocity can be extracted from path-integral migration. The idea of path-integral imaging is to sum over the migrated images obtained for a set of constant migration velocities. By doing so twice, weighting one of the stacks with the velocity value, the stationary velocities that produce the final image can then be extracted by a division of the two images.

Soleimani and Mann combine concepts of DMO correction and CRS stack to properly handle conflicting dip situations during stacking. Based on the CRS traveltime approximation for diffraction events, coherence analysis and stacking are performed separately for any fixed plausible emergence angle within a given range, followed by a superposition of all contributions. For synthetic data we demonstrate the enhancement of diffraction events in the stacked section and their undisturbed superposition with other events. For real data, the approach leads to an improved imaging of faults in the poststack migration results.

Vanelle and Gajewski suggest a new method to combine PP and PS data to obtain a shear velocity model. The method is based on the NIP wave tomography and uses wave field attributes determined with common reflection surface stacking of the data in combination with ray tracing.

Veile and Mann discuss the double diffraction stack method in the context of limited-aperture Kirchhoff migration. The common-reflection-surface stack method provides useful attributes to estimate the size of the optimum migration aperture for zero-offset and its displacement with increasing offset. In practice, the center of the aperture, the location of the stationary point, has to be associated with the corresponding depth point in the migrated domain, e. g. by numerical calculation of the dip of the migration operator. We investigate whether the double diffraction stack is a reliable alternative for that purpose and present first preliminary results.

MODELING

Kaschwich and Bolin: Illumination maps are a useful tool for survey planning and for QC of amplitudes picked on selected target horizons. The Simulated Migration Amplitude technique (SMA) is a ray-based un-weighted Kirchhoff migration of synthetic data around seismic reflectors. In order to enhance illumination mapping for hydrocarbon exploration and reservoir imaging in complex subsurface structures, we present the extension of the SMA to converted waves and in anisotropic media and incorporate noise and attenuation effects.

OTHER TOPICS

Gajewski et al. present a passive seismic real data case study of a hydraulic injection experiment at the German continental deep drilling site KTB and show the influence of anisotropy on the localization of events. For this data the location of events and the shape of the event cloud are substantially altered if the anisotropy is neglected.

Lima et al.: presents a new interactive platform, called BOTOSEIS, that is used to facilitate the application of the Seismic Unix (SU) package, which was developed by the Center of Wave Phenomena (CWP) of the Colorado School of Mines. The BOTOSEIS is built for applying the SU programs by means of graphical user interface. It is developed in Java programming language. The BOTOSEIS platform deserves for creating and managing projects, lines and flowcharts from only one interactive environment. By using the BOTOSEIS the user can run and control several process at one time, and also easily include new SU based applications.

Santos et al. show that the complete set of CRS parameters can be extracted from seismic data by an application of modern local-slope-extraction techniques. The necessary information about the CRS parameters is contained in the slopes of the common-midpoint and common-offset sections at the central point. In this way, the CRS parameter extraction can be sped up by several orders of magnitude.

Ursin et al. extend the kinematical approach of the PP + PS = SS method to second-order traveltimes of the SS-waves. By using the concept and properties of surface-to-surface propagator matrices, the propagator matrix of the SS-wave of a target reflector is explicitly obtained from the propagators of the PP- and PS-wave of the same reflector. Given that the elastic parameters describing S-wave velocities are known along the acquisition surface, this permits to determine the relative geometric spreading of the SS-wave, leading to a better reconstruction of the amplitude of the simulated SS-wave. Under isotropic conditions, the second-order derivatives of the SS-traveltime can, in the same way as for PP-waves, be applied to a tomographic estimation of the S-wave velocity model.

Vanelle and Gajewski suggest a method to evaluate Snell's law in the presence of anisotropy. Their technique is based on first-order perturbation theory and can be used to solve the reflection/transmission problem at a boundary between two anisotropic media with arbitrary symmetry.