Karlsruher PDE-Seminar

Finite-Difference Seismic Modelling and Waveform Inversion

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Nowadays, elastic wavefields are acquired on land, at the seafloor or within tunnels and boreholes. The increasing availability of computational resources allow to use their full information content, e.g., P- and S-waves, converted waves, guided and interface waves, to image geological discontinuities and/or to reconstruct multi-parameter models. For the full consideration of elastic wave propagation effects the efficient forward simulation in 3-D complex media gains in importance. For the forward simulation of elastic wave fields we employ the classical finite difference method. The 3-D viscoelastic wave equations (velocity stress formulation) are discretized on different types of staggered grids. Parallelization is performed using domain decomposition.
Elastic wave field modelling is essential for seismic imaging and inversion but also to invent and verify new seismic reconstruction techniques. One example is the seismic prediction ahead of tunnels. Here, tunnel surface-waves that arrive at the front face of the tunnel are converted into body-waves. Reflected body-waves are later back-converted into tunnel surface-waves. Imaging methods based on these wave fields can successfully detect geological discontinuities ahead.
The ultimative goal, however, is the consistent consideration of all elastic wave propagation effects by full waveform inversion (FWI). Over the last several years, computer resources have brought 2D and 3D acoustic/elastic FWI computations within reach. Some early acoustic field-scale applications have been spectacularly successful, appearing to justify the earlier optimism of Albert Tarantola and others in the 1980s. FWI is currently generating significant interest and excitement in the industrial and academic geophysics communities. The potential of full waveform inversion will be discussed with applications using field and synthetic data.

Termin: Donnerstag, 05. Juli 2012, 17:30 Uhr
Ort: 1C-03, Allianz-Gebäude 05.20
Gastgeber: Die Mitglieder des Schwerpunkts Partielle Differentialgleichungen