Chapter 7

Conclusions

An approach to invert seismic wavefields for elastic parameters is derived and tested. It is based on nonlinear least squares and iteratively updates the P- and S-wave velocity models until the synthetic wavefield computed from this model matches the observed seismic data.

Theoretical analyses coupled with synthetic and field data studies show that both low and high wavenumber components of the P- and S- wave velocities can be resolved from the P-P and P-S events. The high wavenumbers are resolved by amplitudes of events while the low wavenumbers are resolved by shapes of events. The P- and S- wave velocities are constrained in a logical way through the data observations and the elastic wave equation.

The inversion does not require the evaluation of complicated or unstable equations but simply requires seismic wave simulations using the equations of physics. I have chosen elastic finite differences to simulate waves although one could substitute this with any modeling algorithm depending on practical considerations. With the influx of fine grain parallel computers, which are ideally suited to simulations of physics in complicated media, it will become possible to explore and exploit this inversion principle.