Viscoelastic FWI: solving for Q_P, Q_S, V_P, V_S, and density

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QFWI and cross-talk

Viscoelastic FWI

- Full waveform inversion (FWI) is a powerful technique for recovering subsurface properties from seismic data
- FWI is often used to recover P-wave velocity only
- In viscoelastic FWI, elastic and Q terms are recovered, allowing for more accurate treatment of amplitudes

Cross-talk

- Cross-talk occurs when physically distinct variables are confused in the inversion
- Strong cross-talk exists between variables which have similar influence on the data
- This can be assessed by studying radiation patterns

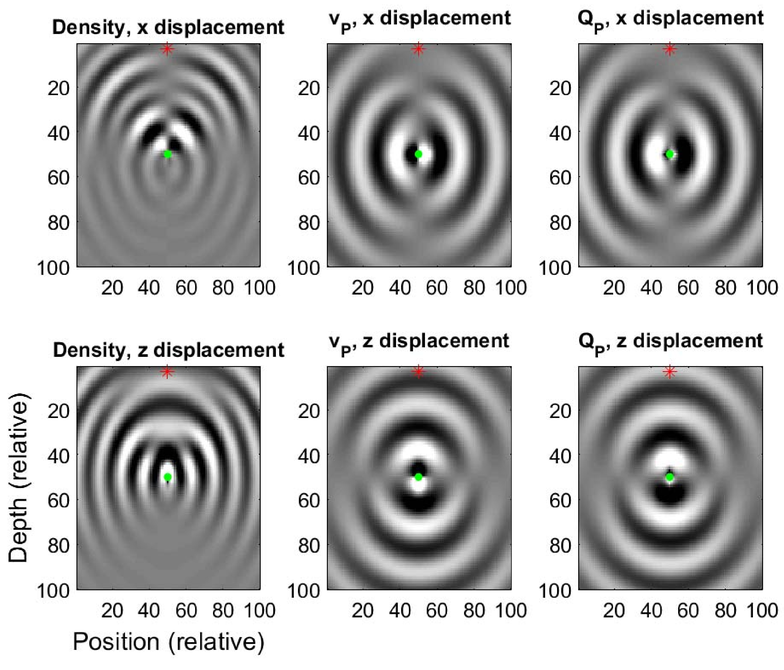

FIG. 1. Scattering potentials for density, V_P and Q_P point perturbations

- V_P and density are often confused in elastic FWI
- V_P and Q_P have even more similar radiation patterns
- V_S and Q_S are also prone to cross-talk

Reducing cross-talk through parameterization

- Changing the model parameterization may reduce reflection related cross-talk between V_P and Q_P

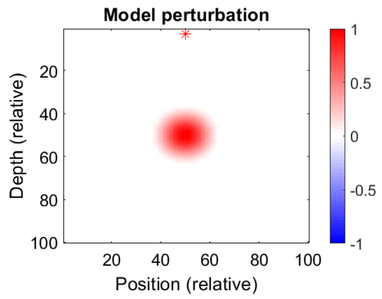

FIG. 2. Alternate variables for characterizing Q

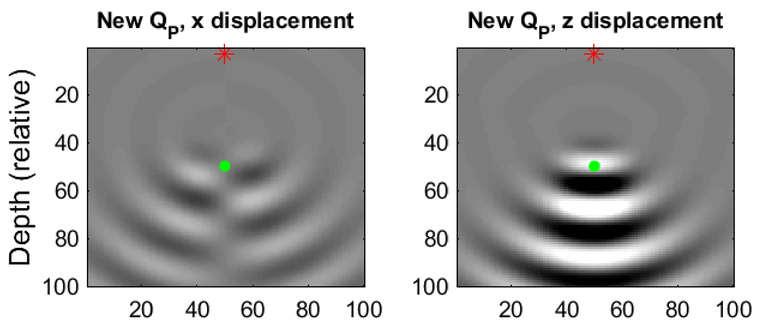

FIG. 3. Radiation patterns for alternate Q_P parameterization

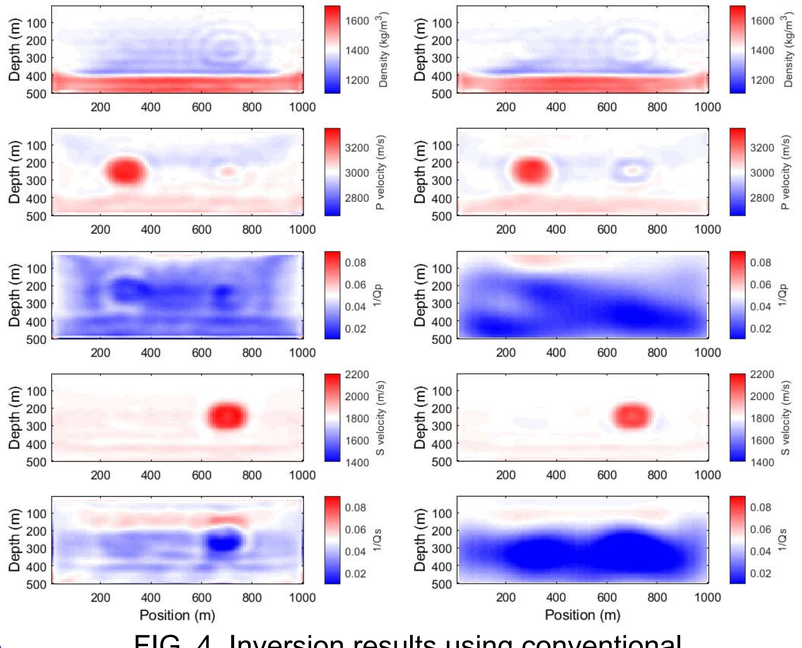

FIG. 4. Inversion results using conventional (left) and alternate (right) variables

FWI for reflectivity

- Appropriate parameter choice can also let FWI more accurately recover reflectivity

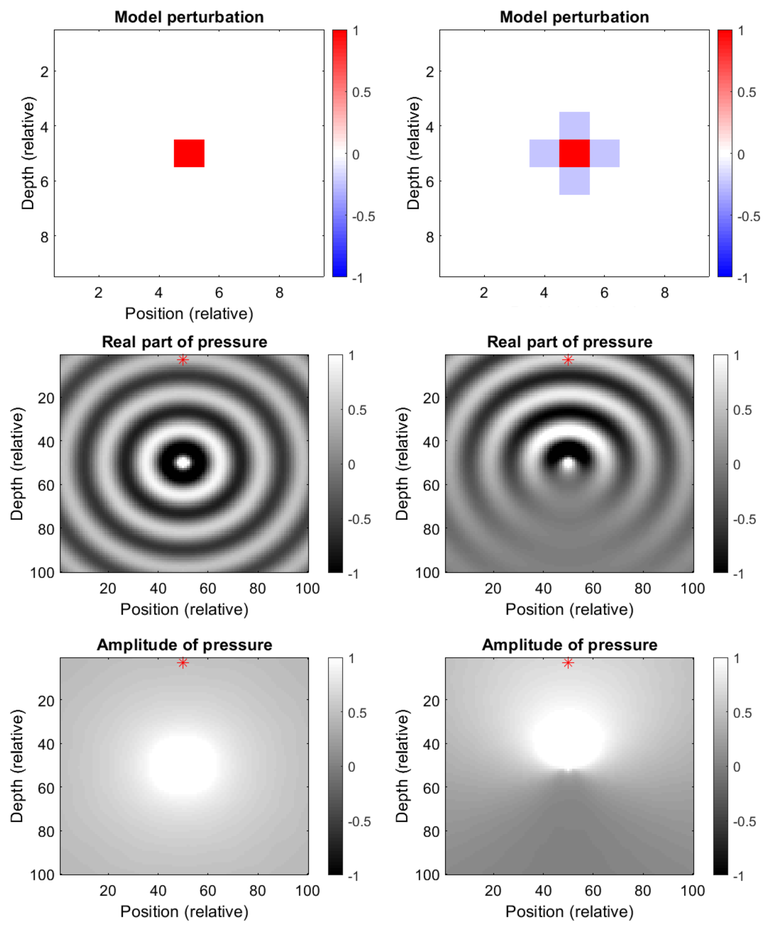

FIG. 5. Variables used (top) and radiation patterns for conventional (left) and reflectivity-type (right) FWI

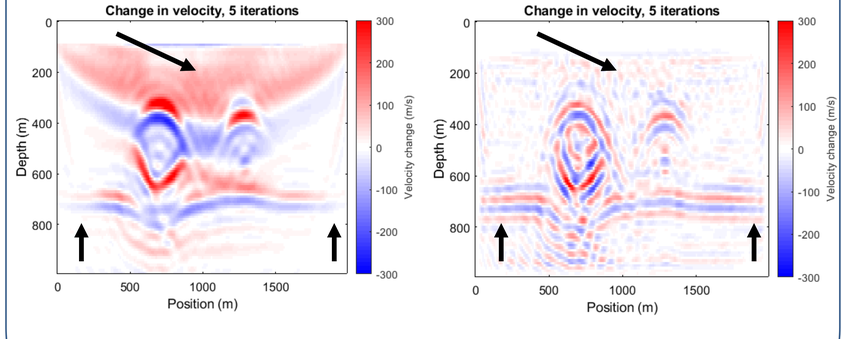

FIG. 6. Inversion result using conventional FWI (left) and reflectivity-type FWI (right)