interferometric imaging condition

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velocity

\[ \nu = \nu_0 + \delta \nu \]

- \( \nu \): true velocity
- \( \nu_0 \): background velocity
- \( \delta \nu \): perturbation velocity
\[ \nu = \nu_0 + \delta \nu \]

- \( \nu \): true velocity
- \( \nu_0 \): background velocity (knowable)
- \( \delta \nu \): perturbation velocity (unknowable)
wave-equation imaging

wavefield reconstruction

imaging condition
wave-equation imaging

wavefield reconstruction
  ➤ non-conventional (tomography/inversion)

imaging condition
  ➤ conventional
wave-equation imaging

wavefield reconstruction
  ▶ conventional

imaging condition
  ▶ non-conventional (interferometry)
experiments

receivers

sources

scatterers

source
conventional imaging

W.R. \[ U(y, t) = \int d\mathbf{x} \, D(x, t) \ast_{t} G(x, y, t) \]

I.C. \[ R(y) = U(y, t = 0) \]
conventional I.C.

modeling with $\nu$
migration with $\nu_0$
correct mapping
incorrect mapping

depth

position

x

y
Wigner distribution functions

time-frequency transformations of complex signals

- Wigner (1932): quantum physics
- Ville (1958): signal processing
- ...
WDF: definition

\[ W(t, \omega) = \int dt_h \ U \left( t - \frac{t_h}{2} \right) U \left( t + \frac{t_h}{2} \right) e^{-i \omega t_h} \]

\[ W(y, k) = \int dy_h \ U \left( y - \frac{y_h}{2} \right) U \left( y + \frac{y_h}{2} \right) e^{-i k \cdot y_h} \]
WDF: end member

\[ W(t) = \int dt_h \ U \left( t - \frac{t_h}{2} \right) U \left( t + \frac{t_h}{2} \right) \]

\[ W(y) = \int dy_h \ U \left( y - \frac{y_h}{2} \right) U \left( y + \frac{y_h}{2} \right) \]
conventional imaging

\[ U(y, t) = \int dx \, D(x, t) \ast_t G(x, y, t) \]

W.R.

I.C.

\[ R(y) = U(y, t = 0) \]
image (CIC)

depth

position
wavefield

wdf[wavefield]
interferometric imaging

\[ U(y, t) = \int d\mathbf{x} \ D(\mathbf{x}, t) \ast_t G(\mathbf{x}, y, t) \]

\[ WDF \] \[ W(y, t) = wdf[U(y, t)] \]

\[ I.C. \] \[ R(y) = W(y, t = 0) \]
robustness to model realization

...images do not change for data generated with different model realizations...
summary

WE imaging:

- conventional wavefield reconstruction
- interferometric imaging condition
acknowledgment

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