Wavefield seismic imaging

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Wide-azimuth imaging

Elastic wavefield imaging

Interferometric imaging

Stereographic imaging

Stream computing
Wide-azimuth imaging

synopsis

- Wide-azimuth acquisition
- Narrow-azimuth processing

- We need to develop methods for
  - illumination compensation
  - multiples suppression
  - model building (velocity, anisotropy)
Wide-azimuth imaging
CWP research

Migration by wavefield extrapolation

- Wide-azimuth wavefield extrapolation
- Extended (cross-correlation) imaging condition
- 3D angle decomposition
Wide-azimuth imaging

Elastic wavefield imaging

Interferometric imaging

Stereographic imaging

Stream computing
Elastic wavefield imaging
synopsis

- Multi-component (vector) acquisition
- Single-component (scalar) processing

- We need to develop methods for
  - anisotropic elastic imaging
  - amplitude reconstruction
  - model building (anisotropy)
Elastic wavefield imaging
CWP research

Multi-component reverse-time migration

- Vector wavefield extrapolation
- Wavefield decomposition in pure wave modes
- Conventional/extended imaging condition
Wide-azimuth imaging

Elastic wavefield imaging

**Interferometric imaging**

Stereographic imaging

Stream computing
Interferometric imaging

synopsis

- Depth migration assumes exact velocity
- Velocity analysis produces approximate velocity

- We need to develop methods for
  - imaging heterogeneous and irregular salt
  - imaging complex stratigraphy
  - imaging basalt, carbonates, etc.
Interferometric imaging
CWP research

Interferometric imaging condition

- Wavefield extrapolation in background model
- Image-space interferometric imaging
- Local averaging for statistical stability
Conventional imaging
Interferometric imaging
Interferometric imaging
Interferometric imaging
Interferometric imaging
Interferometric imaging
Wide-azimuth imaging

Elastic wavefield imaging

Interferometric imaging

**Stereographic imaging**

Stream computing
Stereographic imaging
synopsis

- Data interpretation exploits wavefield structure
- Imaging condition ignores wavefield structure

- We need to develop methods to
  - eliminate cross-talk due to multiple sources
  - eliminate cross-talk due to multi-pathing
  - eliminate cross-talk due to multiple reflections
  - eliminate cross-talk due to multiple wave-modes
Stereographic imaging condition

- Wavefield decomposition prior to imaging
  - propagation time
  - local slope
- Sparse wavefield representation
- Imaging condition in decomposition domain
Multiple sources
Multiple paths
Conventional I.C.

Stereographic I.C.
Wide-azimuth imaging

Elastic wavefield imaging

Interferometric imaging

Stereographic imaging

Stream computing
Stream computing

synopsis

▶ Process seismic data on distributed systems
▶ Moore’s Law is dead! Long live Amdahl’s Law!

▶ We need to develop methods to
  ▶ use new computer architecture
  ▶ use new computing models (streams)
Stream computing

CWP research

Stream processing of seismic data

- Multi-core processing
- Stream processing on GPUs
- Benchmark: finite-difference modeling