MASW Training Course

8 am - 5 pm, Room 147, CMC Building, University of South Florida (USF), Tampa, FL

HANDOUT SUMMARY

Fundamentals of MASW will be covered in the following topical areas:

- Multichannel Seismic Survey
- Data Acquisition (Active and Passive)
- Data Processing (Dispersion and Inversion)
- Typical Applications
- Practice of Data Processing
- Outdoor Demonstration of Data Acquisition
- In-Class Data Processing with Acquired Data

In addition, in-depth coverage of advanced topics will be included in the following categories:

Dispersion Imaging (Complications and Causes)

- Why the fundamental mode (M0) is not necessarily the only dominant mode
- When higher modes (M1, M2, etc.) are dominant
- What determines modal energy partitioning
- How multiple modes get mixed together
- Bedrock depth and dispersion images
- Complications from inverse velocity models
- Understanding fundamentals of dispersion imaging
- Computational artifacts from dispersion imaging
- How to extract dispersion curves from complicated image patterns
- Multi-source offset survey and dispersion images
- Methods to process passive data
- Common pitfalls

Inversion Analysis

- Different Approaches (Pros and Cons):
  - ✓ Traditional fundamental-mode (M0) inversion
  - ✓ Multi-mode inversion (M0, M1, M2, etc.)
  - ✓ Mixed-mode (or apparent mode) inversion
  - ✓ Dispersion image (or phase-velocity spectrum) inversion
  - ✓ Full-waveform inversion
  - ✓ Simple in-field inversion
  - ✓ Inversion of pavement data

- Searching Optimization
  - ✓ Deterministic vs. stochastic approaches
  - ✓ How to optimize the initial velocity model
- Inversion Results
  - ✓ What they represent
  - ✓ What to believe and what not to believe
- Common Pitfalls

Data Acquisition

- How to determine the critical parameters of source offset (X1), receiver spacing (dx), number of channels (Nch), and survey interval (dSR) for 2-D mapping
- How to choose the optimum receiver
  - ✓ Are low-frequency phones (e.g., 4.5 Hz) really critical?
  - ✓ Can higher-frequency phones (e.g., 14-Hz, 40-Hz, etc.) be used?
- How to choose the optimum source
  - ✓ Sledge hammer (10-lb, 20-lb, etc.) or weight-drop?
- Passive Survey
  - ✓ When and how?
  - ✓ How much gain to expect
- Multi-source offset survey: why and when
- How to handle different bedrock depths
  - ✓ Shallow (e.g., ≤ 2m), moderate (e.g., ≤ 10 m), and deep (e.g., > 10 m)
- Surveying over pavement
  - ✓ Shadow zone and investigation depth
  - ✓ Differences in acquisition and processing
- Common Pitfalls

Special Processing

- Back-scattering Analysis of Surface Waves
  - ✓ How it works
  - ✓ Applications
- Common-offset display
  - ✓ What it represents
  - ✓ What different offsets and frequency bands represent

Common Applications

- Soil/Bedrock Mapping
  - ✓ Wind-turbine site surveys and seismic site classification (1-D survey)
  - ✓ Cross-section geotechnical characterization (2-D survey)
  - ✓ Multiple 2-D surveys and depth slicing (3-D survey)
  - ✓ Evaluation of overburden velocities (S- and P-wave velocities; Vs and Vp)
  - ✓ Evaluation of bedrock velocities (Vs and Vp)
- Outcrop Surveys (with Little or No Soil)
  - ✓ Differences in data acquisition and analysis
- Anomaly Detection
  - ✓ Void and loose zone mapping by velocity (Vs) analysis
  - ✓ Use of back-scattering and common-offset analyses
- Compaction Evaluation by MASW Surveys (CEMS)

- ✓ Application to FDR (Full-Depth Reclamation) pavement construction
- ✓ Application to DDC (Deep Dynamic Compaction)

Case Studies

- Actual projects previously performed
  - ✓ Wind-turbine site investigation and seismic site classification (Vs-30m) (1-D Vs profiling)
  - ✓ Seismic site characterization (1-D Vs profile)
  - ✓ Overburden/bedrock investigation (2-D Vs cross section)
  - ✓ Anomaly detection (void/sinkhole investigation)