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## N284: Seismic Attributes and Pre-Stack Inversion Tools for Characterizing Unconventional Reservoirs

Instructor(s): Satinder Chopra

### Format and Duration

Classroom - 4 Days

Virtual - 8 Sessions

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### Summary

Participants will develop the skills required to review, select and interpret the range of seismic attributes and pre-stack inversion tools available for the characterization of unconventional reservoirs including tight sandstones and shales.

### Learning Outcomes

Participants will learn to:

1. Synthesize the various rock physics measurements for unconventional reservoirs that may be estimated from seismic data.
2. Evaluate petrophysical variations in shales, oil sands, and tight sands observed in calibration wells and be able to predict observable differences in the expected seismic response.
3. Assess the influence of tectonic stress history and also the importance of rock properties such as brittleness on reservoir performance.
4. Select appropriate seismic attributes (amplitude, azimuthal anisotropy measurements, AVO, acoustic impedance, elastic impedance, curvature, coherence etc.) expected to be useful predictors of enhanced reservoir performance.
5. Construct rose-diagrams from seismic attributes that can be used to study structural orientations and stress fields.
6. Assess the relevance of seismic inversion measurements such as Lamda-Rho, Mu-Rho, Young's modulus and Poisson's Ratio that might be helpful to engineers in well planning and reservoir stimulation design.

### Training Method

This course combines lectures, case history discussions and guided classroom workshops to establish the theoretical basis for the estimation of certain rock properties using seismic data and enable participants to determine which seismic attributes are most likely to be useful in various reservoir characterization projects.

### Who Should Attend

Geoscientists, processing geophysicists and engineers having an understanding of the fundamental principles of the seismic method, with a minimum of one year's experience interpreting seismic data, and who are interested in learning more about the application of seismic attributes to characterize unconventional reservoirs.

### Course Content



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### 1. Introduction

- Overview of current best practices
- Seismic resolution, spectral enhancements
- Spectral decomposition
- Introduction to seismic inversion methods and geo-statistics
- Impact of local stress and fractures on seismic measurements
- Rock mechanics, seismic inputs for drilling & stimulation
- Seismic measurements as inputs to reservoir characterization
- Overview of seismic toolset; post stack vs. pre-stack attributes

### 2. Curvature attributes

- Coherence Attributes
- Amplitude vs Offset (Angle) interpretation
- Combined Attributes
- Preconditioning of seismic data for attribute analysis
- Guided Interpretation Workshop

### 3. Overview of Shale oil/gas reservoirs

- What can we expect to observe with seismic data?
- Source rock characterization
- Effect of in-situ stresses on seismic response
- Characterization of shale gas reservoirs using prestack inversion tools
- E\_Rho as a brittleness indicator
- Seismic measures as inputs to reservoir characterization & engineering
- Technical challenges, environmental issues
- Case histories, examples
- Guided Interpretation Workshop

### 4. Tight sandstone reservoirs – challenges

- Gas vs. oil vs. water; can we tell the difference?
- Azimuthal anisotropy measurements to predict open fractures
- Seismic measures as inputs to reservoir characterization & engineering
- Case histories, examples
- Summary of seismic attributes
- Guided Interpretation Workshop