EMERSON

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Booth 300

Abstracts

Electrofacies Modeling: Using Multi-Resolution Graph-Based Clustering (MRGC) to Predict Log Properties in Heterogeneous Reservoirs

This presentation demonstrates how electrofacies analysis using MRGC provides better understanding of porosity-permeability relationships in heterogeneous formations, enabling more accurate facies and log property predictions in wells where core information is not available.

Presented by: Pat Stirling

Log Property Modeling: Using Geolog's Offset Model Tool to Model Log Properties in Horizontal Wells

This presentation focuses on the workflow for modeling petrophysical and geomechanical logs from an offset vertical well into a horizontal well using Geolog's Log Property Modeling tool kit. We show how these log properties can be used to improve planning and analysis in both horizontal and offset vertical wells.

Presented by: Pat Stirling

Application of Deep Learning to Pre-stack Data for Feature Identification

Machine learning has emerged as a viable solution for automating the classification of features found in seismic data. Convolutional Neural Networks (deep learning) show great promise for application to both pre-and post-stack to separate different seismic wavefields.

While the traditional processing and imaging workflow is effective, the extensive averaging of the fully recorded wavefield results in an image that is biased towards the dominant energy (specular) wavefields at the expense of other wavefields. These lower energy wavefields carry signatures related to fractures, faults, edges, points, and other structural discontinuities that can control reservoir performance and impact drilling operation decisions. It is possible to recover these features if early integration of the recorded data is minimized or avoided, and if filters are carefully designed to separate these wavefields.

A novel method is presented for decomposing the recorded seismic wavefield into interpretable image volumes that highlight different subsurface features. The method applies Principal Component Analysis to pre-stack depth domain directivity gathers generated with a full-azimuth local angle domain migration, to highlight the principle directivities associated with targeted geometric objects. It is followed by a Convolution Neural Network procedure that automatically classifies continuous structural surfaces (reflectors), discontinuous features (faults, fractures, points), and surface generated noise (acquisition footprint). Preliminary results show superiority over other methods that attempt to isolate wavefields, including Radon transformations and specular/diffraction weighting.

Presented by: Duane Dopkin

Holographic Imaging Extends Seismic Resolution

Images formed from exploration seismic data are an essential element of most exploration and production activities. For the past 40+ years, such images have applied the technology of signal processing both implicitly as in acquisition design, and explicitly in forming the guiding displays. This approach has proved quite effective, but also embodies many recognized limitations. For example, the Nyquist limit affects attainable resolution, and the propagating wavelet loses frequencies, resulting in lost resolution with recording time.

Different technologies for forming images are needed to overcome the resolution limitations of the traditional signal processing method. One such technology is Holographic Imaging, developed by Dr. Norman Neidell. The underlying idea behind holographic imaging is to consider image sampling as independent of acquisition sampling, where the image consists of voxels, representing point reflectors or diffractors. The task of imaging is then to assemble from the captured wavefield (i.e. seismic data as acquired) all the contributions within the data for each voxel.

The Holographic Image is different from standard seismic imaging in several important regards. For example, what was previously described as a reflection boundary would now be seen as a sequence of adjacent voxels, with each having stronger reflective properties. Each individual voxel is now responding as it should according to its character, and not to the source properties or a propagating wavelet as in standard imaging.

While the resultant holographic image has greatly extended resolution, the traditional method of display can no longer effectively and fully represent the enhanced detail now available from using Holographic principles. Displays incorporating Extended Visual Dynamic Range (EVDR) are required that are constructed using a Composite Inversion. The result is a high-resolution image with detail and stratigraphic context that can be used for prospecting and well planning.
Presented by: Duane Dopkin

Big Loop: A Collaborative Approach to Calibrating Subsurface Models for Reliable Production Concept Design and Forecasting
Big Loop™ is an automated ensemble-based workflow that tightly integrates the static and dynamic domains. It enables asset teams to capture uncertainties at every stage of the modeling workflow, allowing them to understand the impact of these uncertainties on the decision-making process. Big Loop employs state-of-the-art machine learning algorithms to produce geologically consistent ensembles of history matched models calibrated to production and optionally 4D seismic data. These ensembles can be reliably used to forecast production performance from oil and gas fields. Being repeatable and updatable, the Big Loop workflow enables the incorporation of data acquired after the model is built and history matched.

Some of big Loop's most important benefits include:
• Capture, propagation and analysis of uncertainty from seismic to simulation
• Collaboration and integration across the domains
• The building of 'fit-for-purpose' models
• Significantly reduced cycle times
• Fast updating of geological and reservoir simulation models, leading to:
• A more accurate reservoir description
• A more robust estimation of STOIIP and reserves uncertainty
• Better informed decisions relating to future development scenarios
Presented by: Sasan Ghanbari

Notes