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# 2010 Central & South America Honorary Lecturer

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## *Quantitative Seismic Analysis and Its Role in Improving Reservoir Description and Exploration Results*

*Presented by Efrain Mendez-Hernandez*
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In the initial stage of the petroleum value chain, seismic interpretation is often qualitative in nature as is appropriate for exploration screening. As we move ahead to development, more data are incorporated, and progressively more quantitative seismic analyses are required for predicting elastic properties and, under a proper tie-to-well data, to infer rock and fluid properties to populate models for reservoir characterization, to develop better EOR strategies, and even to rejuvenate mature fields.

Uncertainty and risk are always inherent to quantitative seismic analysis. Some major "tollgates" will help to mitigate the technical risk. If the seismic and well-log data are not of sufficient quality, the rock physics models do not support determination of reservoir properties through seismic attributes; or if the wavelet derivation does not confirm the fidelity of the seismic data, further expenditures can be avoided. Even then, if these issues have been overcome, a certain level of uncertainty remains due to the nature of the inverse problem, and the way a seismic model is restricted by the real subsurface conditions. These produce, on the whole, nonuniqueness of the final predictions which have to be understood, and constrained. In this stage, a degree of freedom has to be granted to include some valuable qualitative information provided by the experience of the geoscientist, reinforced with reality checks.

In practice, a variety of leading-edge technologies are routinely applied to extract seismic attributes, and, under the proper rock physics framework, to recognize patterns and make quantitative predictions for prospective intervals, and for reservoir characterization and monitoring. As the reservoir heterogeneity becomes more complex, the geologic-economic risk in predicting properties from seismic data also increases. Less deterministic and more multidisciplinary approaches are then demanded for data integration from key disciplines, risk assessment, and quantification of uncertainty. In this nonlinear world, applications to seismically estimate quantitative distribution of physical properties, analyze fizz-water zones, and estimate fracture/density orientation are integrated through probabilistic approaches and soft computing tools including Bayesian formalisms, neural networks, and fuzzy reasoning schemes.

It is well understood that risk and uncertainty are inherent parts of the oil and gas business; however, as the decline of the reservoirs increases and the easy petroleum has gone, more investment capital will be riding on the ability of the geoscientist to objectively quantify physical properties from seismic data based on true multidisciplinary solutions.

### Biography

**Efrain Mendez-Hernandez** received a geophysical engineering degree (1983) from the University of Mexico (UNAM), a master's (1991), with honors, from the University of Mexico (UNAM), a second master's (1999) from the Colorado School of Mines, and a PhD (2008) from the University of Oklahoma.

Efrain has worked for PEMEX E&P since 1985. From 2000 to 2008, he was leader for monitoring industry trends and introducing new technologies for exploration and reservoir characterization. Currently, he is responsible for deepwater exploration activities in a Mexican sector of the Gulf of Mexico.

Dr. Mendez is former President of the Mexican Association of Exploration Geophysicists (AMGE), and the Latin America Geophysical Union (ULG). He is a recipient of the Gabino Barreda Merit Medal from the University of Mexico. In 2004, SEG awarded Efrain Honorable Mention in the Best Oral Presentation category for work presented during the 2003 SEG Annual Meeting.