

**Society of Petroleum Engineers  
Distinguished Lecturer 2017-18 Lecture Season**



**Isotropy: A Fatal Assumption in Shale Geomechanics**

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**Abstract**

By definition, anisotropy is variation of material properties with direction. Preferred orientations of minerals, layering, cleavage, schistosity, foliation, and micro-fractures are the main sources of rock anisotropy. Although anisotropy can be seen in many rock types, shales always exhibit strong anisotropic properties at any scales as they are composed of thinly layered sequences of aligned microscopic clay platelets. Anisotropy has a pronounced effect on the physical and mechanical properties of shale, including acoustic wave propagation, deformation, strength, failure mode, fracturing etc. These changes in the mode of deformation and failure, in turn, influence the outcomes of the routine geomechanical analyses such as wellbore stability, well design, hydraulic fracturing, porosity-permeability evolution, and reservoir performance. Dependent on the inclination of the anisotropy with respect to the principal stress direction, and of course, wellbore trajectory, the importance of anisotropy on rock behavior can vary significantly. Ignoring anisotropy may impose significant additional cost to the oil and gas industry, both conventional and unconventional, and sometimes can even lead to the failure of drilling and production operations. This presentation aims in explaining shale anisotropy, characterization methods and its importance using some interesting field case.

**Biography**

Hamed is an internationally recognized expert in the field of petroleum geomechanics. He holds BSc in Mining Engineering, MSc in Rock Mechanics and PhD in Petroleum Engineering with around 20 years of industry experience in geomechanics working for different consulting, service and operating companies. Hamed is currently working for Dong Energy as Principal Geomechanics Specialist and Team Lead based in Copenhagen, providing project coordination, support and training for geomechanics and petroleum engineering applications.

He is a well-known geomechanics instructor giving short courses for SPE, EAGE, AAPG and PETROLERN and has served as steering committee on several conferences and workshops. Hamed's interest in the last 5 years has been around shale gas geomechanics and shale anisotropy effect. He served as SPE Distinguished Lecturer in the 2012–2013 program.