Paper 14

Geomechanics — Its impact on the life cycle of the reservoir

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One of the greatest challenges in optimizing the development of a reservoir is maximising hydrocarbon recovery with the minimum amount of drilling. Drilling wells efficiently and placing them in the right location can improve recovery and reduce costs. Ensuring that wells are optimally perforated and stimulated with minimal intervention for sanding dramatically increase the efficiency and cost effectiveness of each well. This paper describes the Mechanical Earth Model concept to the drilling of and production from wells. Through the presentation of case studies this paper explains why this is important, how the model is developed and how it is applied to well construction and field development.

The Mechanical Earth Model (MEM) is a numerical representation of the state of stress and rock mechanical properties for a specific stratigraphic section in a field or basin. The model is linked to the geologic structure through the local stratigraphy and a 3D seismic cube. In its basic form, the MEM consists of depth profiles of the elastic and/or elasto-plastic parameters, rock strength and the earth stresses referenced to the local stratigraphic section. Figure 1 shows a 1-dimensional representation of a Mechanical Earth Model and how it is linked to the stratigraphy and 3D seismic cube. In its most complete form, the MEM consists of a full 3D description of pore pressure, stress and mechanical properties. In practice, the complexity of the model evolves in step with acquisition of new information. From exploration to development, the model evolves from a sparse set of 1-dimensional profiles to a full 3D description of rock properties and stresses. This paper will describe the construction of the MEM and the sources of information used for building it. Examples will be shown on how the MEM can be used for various applications like drillbit selection, cementing, hydraulic fracturing, wellbore instability management, sanding prediction and prevention, well placement and design and enhanced recovery in mature fields.

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