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Top-Down, Intelligent Reservoir Model

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Conventional reservoir simulation and modeling is a bottom-up approach. It starts with building a geological model of the reservoir that is populated with the best available petrophysical and geophysical information at the time of development. Engineering fluid flow principles are added and solved numerically so as to arrive at a dynamic reservoir model. The dynamic reservoir model is calibrated using the production history of multiple wells and the history matched model is used to strategize field development in order to improve recovery.

Top-Down, Intelligent Reservoir Modeling approaches the reservoir simulation and modeling from an opposite angle by attempting to build a realization of the reservoir starting with the measured well production behavior (history). The production history is augmented by core, log, well test and seismic data in order to increase the accuracy of the Top-Down modeling technique. Although not intended as a substitute for the conventional reservoir simulation of large, complex fields, this novel approach to reservoir modeling can be used as an alternative (at a fraction of the cost) to conventional reservoir simulation and modeling in cases where performing conventional modeling is cost (and man-power) prohibitive. In cases where a conventional model of a reservoir already exists, Top-Down modeling should be considered as a compliment to, rather than a competition for the conventional technique, to provide an independent look at the data coming from the reservoir/wells for optimum development strategy and recovery enhancement.

Top-Down, Intelligent Reservoir Modeling starts with well-known reservoir engineering techniques such as Decline Curve Analysis, Type Curve Matching, History Matching using single well numerical reservoir simulation, Volumetric Reserve Estimation and calculation of Recovery Factors for all the wells (individually) in the field. Using statistical techniques multiple Production Indicators (3, 6, and 9 months cum. production as well as 1, 3, 5, and 10 year cum. oil, gas and water production and Gas Oil Ratio and Water Cut) are calculated.

These analyses and statistics generate a large volume of data and information that are snapshots of reservoir behavior in discrete slices of time and space. This large volume of data is processed using state-of-the-art in artificial intelligence and data mining (neural modeling, genetic optimization and fuzzy pattern recognition), first using a set of discrete modeling techniques to generate production related predictive models of well behavior. The set of discrete, intelligent models are then integrated using a continuous fuzzy pattern recognition algorithm in order to arrive at a cohesive picture and model of the reservoir as a whole.

The Top-Down, Intelligent Reservoir Model is calibrated using the most recent set of wells that have been drilled. The calibrated model is used for field development strategies to improve and enhance hydrocarbon recovery.