An Integrated Experimental Design Solution to Address Production Forecast Uncertainty in Unconventional Reservoirs

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ABSTRACT

Development of unconventional reservoirs is usually associated with wide ranges of uncertainty related to reservoir static properties and dynamic fluid flow behavior. Lack of field data, data integration, quantifying reservoir uncertainties, and understanding the synergy between different prediction tools are typical challenges during early field development planning. Several numerical and analytical methods are currently available to estimate reserves, material balance, and production behavior in unconventional reservoirs. Relying on a single modeling tool could be misleading. It is, therefore, crucial to assess different modeling approaches to evaluate the quality of predictions. Tools selection and integration are not well understood. This work introduces a comprehensive modeling workflow to address uncertainties associated with production forecast from unconventional gas reservoirs. We discuss how to estimate the range of uncertainties of key parameters such as reservoir rock and fluid properties, probabilistic predictions to assess well productivity potential, and design parameters that incorporates well spacing and number of hydraulic fracture stages. The proposed workflow integrates analytical tools and reservoir simulations within an experimental design framework. While the proposed approach is essentially demonstrated for a synthetic shale gas reservoir, many aspects of the workflow and can be readily generalized for other unconventional field cases.