AAPG
3rd Edition
AAPG Decision Based Integrated Reservoir Modeling GTW
24-26 November 2025 | Al-Khobar, Saudi Arabia

From Uncertainty to Insight: Leveraging on Multiple Realization Simulation Models

Sudirman Sharizan[1], Ali Ismail Fahmy[1], Maucec Marko[1]

[1]Saudi Aramco

Abstract

Objective: The hydrocarbon reservoir studies are complex, simulation models are a powerful tools for decision-making and analysis. However, the intrinsic spatio-temporal variability and subsurface systems often lead to significant challenges in producing reliable prediction results. The concept of "multiple realization" simulation models, which involve generating ensembles of plausible representations of a subsurface system to account for uncertainty and to capture a wide range of potential outcomes, is in upright trend. By leveraging such models, the limitations inherent to single deterministic approaches are mitigated by gaining deeper insights through multiple scenario with embedded uncertainty quantification, which improves the robustness of predictions.

Methodology: The study delves into the methodology of multiple realization simulation models, emphasizing their ability to incorporate diverse scenarios, parameter variations, and stochastic processes. It highlights how this approach enables the quantification of uncertainty, identification of critical factors, and exploration of "what-if" scenarios, ultimately leading to more informed decision-making. The multiple realization simulation approach also requires the input from multiple domains and interdisciplinary collaboration to ensure they are comprehensive and well-rounded.

Results and Conclusions: The study concludes by emphasizing the importance of adopting multiple realization simulation models in an era where uncertainty is pervasive. It underscores their potential to support the decision-making processes by providing a comprehensive understanding of complex systems and fostering resilience in the face of unpredictability. Despite the challenges in their practical implementation, ongoing advancements in technology and methodology are continually improving their accessibility and effectiveness.

Value Addition: By leveraging multiple realization simulation models and associated stochastic scenarios, stakeholders can transform uncertainty into a source of insight, enabling better outcomes and more sustainable solutions.