Model reduction for a coupled nearwell and reservoir models using multiple space-time discretizations.

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Proper reservoir management often becomes challenging to be performed due to the intrinsic uncertainties and complexities associated with the reservoir properties. To this end, accurate results for reservoirs are obtained if fine grid discretization is induced into the model. This leads to large-scale system of nonlinear equations that needs to be solved every time step. The importance of obtaining a simpler model that can represent the physics of the full system is paramount to speed up the workflows that require several (from dozen to thousands) calls of the forward model.

Over the past decade, numerous techniques have been applied in the context of porous media flow simulation to reduce the computational effort associated with the solution of the underlying coupled nonlinear partial differential equations. In many cases, reduced-order modeling techniques have shown to be a viable way of mitigating computational complexity in simulation of the large-scale model, while they maintain high level of accuracy when compared with here high fidelity models. Many of these simulation models treat the reservoir as a whole model. In many cases, the nearwell accuracy is very important because it controls the production rate. In fact, researchers often use more complex near well models to achieve a high accuracy. In this talk, I will describe model reduction techniques that consider near well and reservoir regions separately and use different spatial grids and temporal accuracy to achieve efficient and accurate reduced order models.