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NESTED SAMPLING FOR CALIBRATION AND PRIOR MODEL SELECTION OF SUBSURFACE FLOW MODELS

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The Bayesian framework is the most general framework for uncertainty quantification and model calibration. However, the high computational costs of performing a full Bayesian analysis limits the applicability of this framework to small scale problems. Recently, the nested sampling (NS) algorithm [1] was proposed for efficient estimation of the Bayesian evidence (marginal likelihood) and for obtaining samples from the posterior distribution of the unknown fields. NS utilizes an active set of samples that evolves to high-likelihood regions. The sample evolution process is achieved by iteratively discarding the sample with the lowest likelihood within the active set by a new sample from the prior with higher likelihood value (constrained sampling). NS was successfully applied for inverse uncertainty quantification (UQ) and prior model selection of subsurface flow models [2; 3; 4]. In the current talk, different techniques to increase the efficiency of the NS algorithm will be discussed. The use of approximate gradients based on ensemble techniques is one promising method. The second technique is based on two–stage local sampling guided by an adaptively fitted polynomial chaos response surface.

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