Predictability and Solution Error Models for Flow in Porous Media

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Prediction with the quantification of uncertainty is needed to take advantage of the opportunities created by modern simulation. As more of the stages of scientific inquiry are computationally based, there is an increased need to automate some of the decision processes associated with the computation.

Error models for numerical solutions (as well as for observations) are the basic ingredient for uncertainty quantification. It is the comparison of solutions to observations which refines our models of porous media (through history matching). The probability of error in either generates the probability for accuracy of some model of the media. This probability, together with a forward simulation (and its error with probability) generates confidence intervals for prediction.

This talk will develop a general stochastic framework for prediction, based on error models for numerical solutions of partial differential equations, and illustrated by problems of turbulent mixing and flow in porous media. Recent results of the speaker and collaborators will be presented.