Contribution ID: **454** Type: **Poster (+) Presentation**

Uncertainty-aware Validation Benchmarks for Coupling Free Flow and Porous-Medium Flow

Wednesday, 2 June 2021 10:00 (1 hour)

A correct choice of interface conditions and useful model parameters for coupled free-flow and porous-medium systems is vital for physically consistent modeling and accurate numerical simulations of applications. We consider the Stokes-Darcy problem with different coupling strategies: classical and generalized interface conditions on the sharp fluid-porous interface and the pore-network model. The classical set of interface conditions is the most widely used coupling concept in the literature; however, it contains several uncertain parameters. We quantify these uncertainties and study the coupled flow problem's behavior considering several benchmark cases, where the pore-scale resolved model is used as the reference solution. The coupled Stokes-Darcy model with the classical set of interface conditions is also validated by comparing the pore-network model and the recently developed generalized interface conditions. All the model parameters are computed based on the pore geometry.

We apply a statistical framework that incorporates a probabilistic modeling technique using a fully Bayesian approach to accomplish these goals. A Bayesian perspective on a validation task yields an optimal bias-variance trade-off against the reference data. It provides an integrative metric for model validation that incorporates parameter and conceptual uncertainty. Additionally, a model reduction technique, namely Bayesian Sparse Polynomial Chaos Expansion, is employed to accelerate the calibration and validation processes for computationally demanding models for Stokes-Darcy problem with different coupling strategies. We perform uncertainty aware validation, demonstrate each model's predictive capabilities, and make a model comparison using Bayesian validation metrics.

Time Block Preference

Time Block A (09:00-12:00 CET)

References

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