Contribution ID: **391** Type: **Oral Presentation**

Multilevel Monte Carlo Method for Simulation of Propagation of Uncertainties in Fractured Porous Media

Monday, 13 May 2024 11:40 (15 minutes)

Simulation of salinization of coastal aquifers plays an important role in prediction of availability of pure water resources. In these geological formations, fractures introduce strong heterogeneities and their influence on the groundwater flow and the transport of the salt is significantly (cf. [1]). However uncertain variations in hydrogeological parameters such as porosity, permeability, fracture aperture etc. may essentially reduce accuracy of the prediction of the transport phenomena. In this talk, we present an application of the multilevel Monte Carlo method for estimation of propagation of the uncertainty from the parameters of the fractured porous medium to the solution in the subsurface density-driven flow model represented by a system of non-linear PDEs. This research is a continuation of our recent work on the uncertainty quantification for this type of models (cf. e.g. [2]). We test this approach on a model problem with the random porosity field, recharge and fracture aperture that represent the limited knowledge of the data. Parallelization is applied to the Monte Carlo method. We present results of numerical experiments on the supercomputer Shaheen II.

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References

[1] A. Grillo, D. Logashenko, S. Stichel, G. Wittum, Simulation of Density-Driven Flow in Fractured Porous Media, Advances in Water Resources, Vol. 33, No. 12 (2010), pp. 1494-1507, DOI: 10.1016/j.advwatres.2010.08.004,
[2] A. Litvinenko, D. Logashenko, R. Tempone, E. Vasilyeva, G. Wittum, Uncertainty Quantification in Coastal Aquifers Using the Multilevel Monte Carlo Method, PAMM, 2023. DOI: 10.1002/pamm.202300005

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Session Classification: MS07

Track Classification: (MS07) Mathematical and numerical methods for multi-scale multi-physics, nonlinear coupled processes