Contribution ID: **591** Type: **Oral Presentation**

A parallel recursive implementation of the Multiscale Perturbation Method for two-phase flow

Wednesday, 2 June 2021 15:00 (15 minutes)

We investigate the approximation of two phase flows in porous media using the Multiscale Perturbation Method (MPM) [1] to compute velocity fields, in a parallel recursive implementation. Since an elliptical equation must be solved at each simulation level in multiphase flow problems approximated by operator splitting, the MPM makes use of classical perturbation theory in order to avoid all multiscale basis functions to be recomputed. We replace the full upgrade of local solutions with the reuse of multiscale basis functions that have previously been calculated by making use of the Recursive Multiscale Robin Coupled Method [2], developed in a multiscale parallel domain decomposition framework. It is well known that non-overlapping domain decomposition schemes have great potential to take advantage of multi-core, state-of-the-art parallel computers, and the current approach is capable of speeding up the solution of multiphase flow problems. Avoiding the recalculation of basis functions is a prominent feature that can be extended to situations in which countless problems with relatively close permeability fields must be solved, such as uncertainty quantification problems. Here, we present numerical examples for challenging, high-contrast permeability fields and investigate the good scalability properties of MCRM for large problems in subsurface flows.

[1] A. Ali, , H. Mankad, F. Pereira, and F. S. Sousa. "The multiscale perturbation method for second order elliptic equations".Applied Mathematics and Computation 387 (2020): 125023.
[2] E. Abreu, , P. Ferraz, A. M. Espírito Santo, F. Pereira, L. G. C. Santos, and F. S. Sousa. "Recursive formulation and parallel implementation of multiscale mixed methods." (2020).

Time Block Preference

Time Block C (18:00-21:00 CET)

References

[1] A. Ali, , H. Mankad, F. Pereira, and F. S. Sousa. "The multiscale perturbation method for second order elliptic equations".Applied Mathematics and Computation 387 (2020): 125023.
[2] E. Abreu, , P. Ferraz, A. M. Espírito Santo, F. Pereira, L. G. C. Santos, and F. S. Sousa. "Recursive formulation and parallel implementation of multiscale mixed methods." (2020).

Acceptance of Terms and Conditions

Click here to agree

Newsletter

Student Poster Award

Primary authors: Dr ESPÍRITO SANTO, Arthur (Universidade Federal do Rio Grande do Sul); ABREU, Eduardo (University of Campinas, Sao Paulo, Brazil); PEREIRA, Felipe (Mathematical Sciences Department, The University of Texas at Dallas, Richardson, TX, USA); SOUSA, Fabricio (University of Sao Paulo); Ms ROCHA, Franciane (University of Sao Paulo)

Presenter: Dr ESPÍRITO SANTO, Arthur (Universidade Federal do Rio Grande do Sul)

Session Classification: MS14

Track Classification: (MS14) Uncertainty Quantification in Porous Media