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A New Upscaling Strategy for Flow in Fractured Porous Media

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Given the high uncertainty of fracture characteristics in subsurface porous media, we focus in our work on the prediction of the mean or Ensemble Averaged Flow (EAF) field. Typically fractures can cover distances comparable to the size of the domain of interest. While classical homogenization only is valid for representative elementary volumes (REV) much larger than all embedded structures, the presented approach does not rely on such restrictions. The new model, which is formulated at this point for many isolated fractures, relies on a nonlocal multi-media description based on coupled integro-differential equations. It is shown how a previous description for fractures of equal length and aperture can be extended for much more realistic scenarios with multiple fracture families. With a series of numerical studies and comparisons with Monte Carlo reference data it is demonstrated that also for such more complex scenarios the devised sub-REV model accurately captures mean flow rates and pressure profiles for arbitrary domain sizes.

Participation

In-Person

References

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