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Generalized framework for flow in fractured subsurface formations

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While isolated fractures are difficult to fully characterize in subsurface formations, they serve as highly conductive long-range flow conduits and thus may have a strong influence on flow and transport. Recently, we have proposed a new model for flow in fractured formations that provides predictions of the expected flow field. Unlike existing methods, this model accounts for the non-local effect of these flow conduits using kernel functions that appear in an integro-differential flow balance equation. In the present work, kernel functions predicting mean flow rates and pressure profiles for a variety of fracture shapes are presented. Furthermore, discrete fracture length distributions are incorporated leading to a formalism that can account for mixtures of different fracture families. A series of numerical experiments are presented with the results being successfully compared to expensive fine-scale reference simulations.

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