Interface Preconditioners for Multiphysics Problems

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**ABSTRACT**

Our work concerns preconditioners for coupled multiphysics problems with a special interest in interfacial coupling. In many cases, the interface problems are naturally formulated as a sum of fractional Laplace equations including both negative and positive fractionalities.

To solve efficiently such problems, we first present the factorization-based approach to handling the sum of fractionalities, which results in a multiplicative solver composed of multigrid methods. Alternatively, we also apply the rational approximation method as an additive solver that represents the fractional power as a sum of rational functions.

We showcase the effectiveness and robustness of our methods both analytically and numerically on several numerical examples, such as Darcy-Stokes and 1D-3D problems.