

# Conditioning Immersed Finite Element Methods

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## ABSTRACT

Immersed methods are promising tools to preclude expensive (re-)meshing operations for fluid-flow problems around complex objects (*e.g.*, [1]), fluid-structure interaction problems with large deformations (*e.g.*, [2, 3, 4]) and flows problems on scanned domains (*e.g.*, imbibition of porous media). A common pitfall of these techniques is ill-conditioning, which generally occurs when the system contains elements with small support in the fluid domain [2, 3, 4, 1]. We demonstrate that the condition number of immersed methods depends on the smallest element in the system in a similar manner as derived in [5] for symmetric and elliptic problems. Based on the same principles as the preconditioner developed in [5], we develop a tailored preconditioner for immersed flow problems. We demonstrate the performance of this preconditioner for various test cases, including Stokes and Navier-Stokes.

## REFERENCES

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