HSS Preconditioner for Incompressible Navier-Stokes Equation on Multiscale Unstructured Mesh

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Abstract

In this paper, we firstly generate the multiscale unstructured mesh by the mesh generator, then we discretize incompressible Navier-Stokes equation (NSE) by finite element method and linearize it by Newton/Picard iteration, and we obtain the linear system from incompressible NSE with the saddle point structure. Since the linear system is a large sparse matrix with full rank, we solve the system by GMRES. To further accelerate the solution speed, we apply Hermitian/Skew-Hermitian Separation (HSS), a newly developed preconditioner, to the solver GMRES, and finally we provide two-dimensional numerical examples. Computational results show that, the mesh generator will produce multiscale mesh for complex geometries, and HSS can significantly increase the solution speed of incompressible NSE.

Key words: Incompressible Navier-Stokes equation, multiscale mesh, GMRES, preconditioner, HSS