PARALLEL IMPLEMENTATION OF SHUR COMPLIMENT BASED PRESSURE POISSON EQUATION

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To parallelize a fully developed fluid solver, for example, one naturally decomposes a computational domain along the streamwise direction due to an explicit numerical time integration treatment on that direction. Therefore, the grid spacing is uniform in the streamwise direction, and together with the adoption of the periodic boundary conditions, the fast Fourier transform (FFT) can be used to reduce the 3D Poisson equation to several uncoupled 2D algebraic system of equations. However, this approach requires the global flow information in the periodic direction. In the distributed-memory parallel implementation, the need of all-to-all communications in the periodic direction is the main bottleneck to degrade the efficiency of the FFT algorithm for large-scale problems, especially with a large number of processors. Alternatively, the domain decomposition can be done in the inhomogeneous directions, this then avoids the need to all-to-all communications. Possible parallel implementations of Shur compliment based pressure poisson equation are addressed here.