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Local method of approximate particular solutions for unsteady Navier-Stokes problem

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The local method of approximate particular solutions (LMAPS) is a kind of meshless method using radial basis functions (RBFs) which is first developed and implemented to solve numerically two-dimensional, incompressible and unsteady Navier-Stokes equations containing Laplacian operator. In order to overcome the instability of the ill-conditioning problem, the weighting coefficients of linear combination with respect to all order derivatives of a function are determined by solving low-order linear systems within local supporting domain. Then local matrix is reformulated in the global and sparse matrix. Fractional step algorithm is required to circumvent the difficulties arising from lack of an independent equation for the pressure. The pressure Poisson equation can be directly solved by the LMAPS throughout the whole domain instead of more complicated Successive Over-Relaxation (SOR) iterative method. The numerical experiments have shown that the developed LMAPS is suitable for solving the incompressible Navier-Stokes equations with high accuracy and efficiency.

Keywords: Navier-Stokes equations, LMAPS, Radial Basis Functions (RBFs), Large sparse linear systems