Global Method of Approximate Particular Solutions for solving the rectangular two-sided lid-driven cavity problem for two-dimensional and incompressible flow.

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ABSTRACT

The two-dimensional Navier-Stokes equations in primitive formulation are solved by the global Method of Approximated Particular Solutions (MAPS). The proposed scheme provides a good treatment of the nonlinearities in the momentum equations by using the Newton-Raphson method with variable step. Radial Basis Functions (RBFs) are used as source terms in the Stokes equations in order to obtain particular solutions for the linear part of the momentum equations. A closed-form expression of the particular solutions as a function of domain coordinates are obtained by employing Oseen's decomposition formula. The velocity particular solutions attained satisfy the continuity equation and are used to approximate the dependent variables of the problem.

A variation of the classical lid-driven cavity problem, the rectangular two-sided lid-driven cavity flow, is solved with the numerical scheme developed. In this case, the movement of fluid occurs as a result of the constant movement of the two vertical sides. The flow pattern is related to the cavity aspect ratio and the Reynolds number, *Re*. In this paper, a rectangular cavity with constant height equal to 1 and $Re = 700$ are considered and the variation in cavity width, $1 \leq l \leq 2.5$, is analysed. Numerical results reproduce the flow pattern change when increasing $l = 1.995$ to $l = 2$ showing good agreement with results reported in the literature.

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