Fully Consistent SIMPLE-Like Algorithms on Collocated Grids

To increase the convergence rate of SIMPLE-like algorithms on collocated grids, a compatibility condition between mass flux interpolation methods and SIMPLE-like algorithms is presented. Results of unsteady flow computations show that the SIMPLEC algorithm, when obeying the compatibility condition, may obtain up to 35% higher convergence rate as compared to the standard SIMPLEC algorithm. Two new interpolation methods, fully compatible with the SIMPLEC algorithm, are presented and compared with some existing interpolation methods, including the standard methods of Choi [9] and Shen et al. [8]. Numerical results show that the time-step dependence of the standard methods may double the total discretization error at steady state. It is furthermore shown that the new methods are independent of time step and relaxation parameter at convergence. One of the new methods is shown to give a higher accuracy than the standard methods.

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