Development, Verification and Validation of an In-House CFD Code for Weakly Compressible Flow

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Abstract:

The work of this paper represents the first stage of a whole modeling and computational solution procedure for an on-going research on agricultural fires at the laboratory of environmental research, Assiut University. The paper presents an accurate and efficient semi-implicit pressure-based algorithm developed for solving numerically the conservation equations governing weakly compressible single-fluid flows. The algorithm uses a finite-volume technique applied to structured non-orthogonal multi-block curvilinear meshes with co-located grid arrangement. An in-house CFD code has been developed to implement the numerical solution of the present algorithm. The code is an integrated one consisting of the main elements, the pre-processor, the solver and the post-processor. This in-house CFD code undergoes a standard verification and validation process using a variety of standard test cases covering broad range of CFD applications. The results of the present code for all test cases are in good agreement with those of the well-established reference CFD codes. This insures the present code verification and validation.

Keywords:

CFD codes; weakly compressible flows; lid-driven square cavity flow; flow over pump in a channel; unsteady flow past downstream facing step; flow over a hot flat plate.

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