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IRBFEs for the numerical solution of steady incompressible flows

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Summary

In this paper, we develop a control-volume technique based on 2-node integrated-radial-basis-function elements (IRBFEs) for the numerical solution of steady incompressible flows governed by the stream function-vorticity formulation. The fluid domain is discretised by a Cartesian grid from which non-overlapping rectangular control- volumes are formed. Line integrals arising from the integration of the diffusion and convection terms over control volumes are evaluated using the middle-point rule. The convection term is effectively treated by the upwind scheme with deferred correction strategy. Instead of using conventional low-order polynomials, all physical quantities at the interfaces are presently estimated by means of 2-node IRBFEs. Attractive features of the proposed technique include (i) the solution is C2-continuous across the elements and (ii) a wide range of the RBF shape parameter can be used. Numerical results are presented for several two-dimensional benchmark problems defined on rectangular and non-rectangular domains. keywordIntegrated-radial-basis-function elements, Cartesian grids, control volume, local approximation, upwind scheme, deferred-correction strategy