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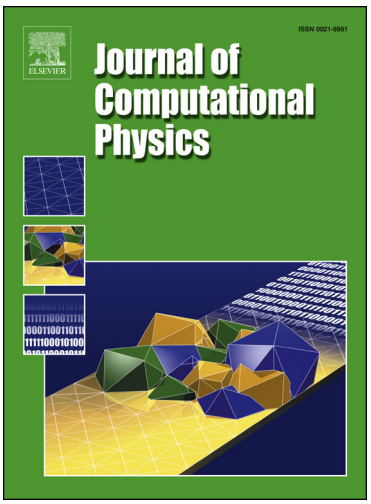

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Can adaptive grid refinement produce grid-independent solutions for incompressible flows?

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Abstract

This paper studies if adaptive grid refinement combined with finite-volume simulation of the incompressible RANS equations can be used to obtain grid-independent solutions of realistic flow problems. It is shown that grid adaptation based on metric tensors can generate series of meshes for grid convergence studies in a straightforward way. For a two-dimensional airfoil and the flow around a tanker ship, the grid convergence of the observed forces is sufficiently smooth for numerical uncertainty estimation. Grid refinement captures the details of the local flow in the wake, which is shown to be grid converged on reasonably-sized meshes. Thus, grid convergence studies using automatic refinement are suitable for high-Reynolds incompressible flows.

Keywords: grid adaptation, grid convergence, uncertainty estimation, hydrodynamic flows

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