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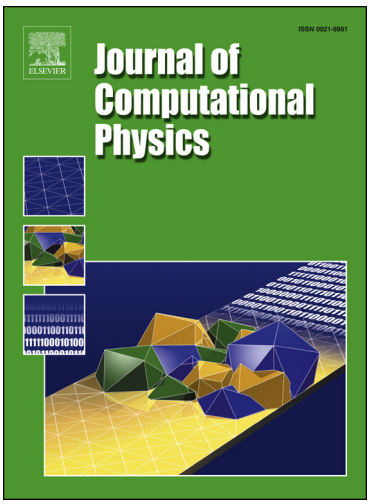

Implicit boundary equations for conservative Navier–Stokes equations

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Highlights

- Following the theory of characteristics, it is shown boundary conditions essentially introduce a correction vector to the original NS equations. A correction matrix T is introduced to account for this effect.
- The resulting equations $\partial Q/\partial t = (I+T)R$ are applicable for the entire truncated computational domain, i.e. both for the interior domain ($T = 0$ recovers the original NS equation) and on boundaries ($T \neq 0$ preserve the imposed physical boundary conditions precisely). This is independent of the time and spatial dicretization schemes;
- One-sided spatial schemes can be directly applied to discretize the conservative equations on boundary points, and are still shown to be stable;
- The boundary residuals are computed more accurately, and accelerate the convergence rates of implicit solutions significantly.
- Development and computer code implementation of the conservative form of implicit boundary treatment are made significantly easy, especially for multi-dimensional problems where different boundary conditions are imposed at the same edge or corner points.