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A Pressure-Correction Method for All Mach Numbers

Krista Nerinckx, Jan Vierendeels, **Erik Dick**

Ghent University, Department of Flow, Heat and Combustion Mechanics, Ghent, Belgium

We present a collocated finite-volume-based pressure-correction method, for all speed flows of a general fluid. Over the whole Mach number range, the algorithm shows an excellent efficiency and accuracy. Mach-uniform accuracy is obtained by applying the Advection Upstream Splitting Method (AUSM+) for the flux definitions, with adaptations for low Mach number stability. Mach-uniform efficiency is obtained by treating the convective phenomena and the acoustic/thermodynamic phenomena separately: a velocity predictor from the momentum equations, and a coupled solution of the continuity and energy equation for pressure and temperature corrections. Doing so, acoustics are treated implicitly and an acoustic CFL-limit is avoided. The algorithm finds its place in between a fully segregated and a fully coupled approach. It is valid for a general fluid, including special cases like a constant density fluid and an ideal gas.

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