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Inviscid Steady Flow Simulation Around a Wing Configuration Using MB_CNS

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Abstract : Simulation of a high speed inviscid steady ideal air flow around a 2D/axial-symmetry body was carried out by the use of mb_cns code. mb_cns is a program for the time-integration of the Navier-Stokes equations for two-dimensional compressible flows on a multiple-block structured mesh. The flow geometry may be either planar or axisymmetric and multiply-connected domains can be modeled by patching together several blocks. The main simulation code is accompanied by a set of pre and post-processing programs. The pre-processing programs scriptit and mb_prep start with a short script describing the geometry, initial flow state and boundary conditions and produce a discretized version of the initial flow state. The main flow simulation program (or solver as it is sometimes called) is mb_cns. It takes the files prepared by scriptit and mb_prep, integrates the discrete form of the gas flow equations in time and writes the evolved flow data to a set of output files. This output data may consist of the flow state (over the whole domain) at a number of instants in time. After integration in time, the post-processing programs mb_post and mb_cont can be used to reformat the flow state data and produce GIF or postscript plots of flow quantities such as pressure, temperature and Mach number. The current problem is an example of supersonic inviscid flow. The flow domain for the current problem (strake configuration wing) is discretized by a structured grid and a finite-volume approach is used to discretize the conservation equations. The flow field is recorded as cell-average values at cell centers and explicit time stepping is used to update conserved quantities. MUSCL-type interpolation and one of three flux calculation methods (Riemann solver, AUSMDV flux splitting and the Equilibrium Flux Method, EFM) are used to calculate inviscid fluxes across cell faces.

Keywords : steady flow simulation, processing programs, simulation code, inviscid flux
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