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A Stable Hybrid Implicit/Explicit Scheme for Large-Eddy Simulation of Compressible Flows in Complex Geometries MOHAMMAD SHOEYBI, FRANK HAM, MAGNUS SVARD, PARVIZ MOIN, Stanford University — An unstructured Finite-Volume based CFD solver for Large-Eddy simulation of compressible flows in complex geometries has been developed. Spatial derivatives are discretized using node-based centered Finite-Volume scheme that satisfies the Summation By Parts (SBP) property on a general polyhedral unstructured grid. Boundary conditions are imposed weakly using the Simultaneous Approximation Term (SAT) technique. The SBP property of the discretization operators in conjunction with the penalty method (SAT) leads to a low-dissipation numerical algorithm with provable stability properties. Unstructured meshes together with the flow variables make fully implicit schemes computationally expensive and memory intensive. A criterion has been derived to adaptively divide the resulting system into explicit and implicit parts resulting in an efficient and less memory intensive time advancement scheme. The method has been verified with several test cases including a viscous shock, a two dimensional vortex, homogenous isotropic turbulence and turbulent flow around a cylinder at Re=3900.

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