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Explicit Multirate Runge-Kutta Time Advancement for Navier-Stokes on Unstructured Grids[1] PAUL COVINGTON, FRANK HAM, PARVIZ MOIN, CTR, Stanford University — Unstructured grids of complex geometries often contain a handful of very small or poor quality elements that severely limit the global CFL-restricted timestep for explicit time advancement. So-called Multirate Runge-Kutta (MRK) methods attempt to overcome this limitation by using different time integration schemes in different regions of the domain based on a local stability criterion, thereby reducing overall computational cost (E. Constantinescu, JSC 2007 & M. Schlegel, JCAM 2009). In this study, concepts from MRK are combined in a novel way to speedup an unstructured compressible finite volume code. As a validation case, the evolution of a 2D Euler vortex on a recursively refined grid will be presented. Algorithmic issues such as load balancing will also be discussed since these are crucial to approaching the theoretically achievable speedup. The practical implications of this technique will be demonstrated on a large-scale simulation of a low Mach number automotive fan.

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