Abstract Submitted
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How Many Grid Points Are Required for Time Accurate Simulations?[1] AYABOE EDOH, ANN KARAGOZIAN, University of California, Los Angeles, NATHAN MUNDIS, ERC, Inc., VENKATESWARAN SANKARAN, Air Force Research Laboratory — Grid resolution is a key element in a numerical discretization scheme's ability to accurately capture complex fluid dynamics phenomena encountered in LES and DNS calculations. The fundamental question to be asked concerns the minimum number of points required to represent relevant flow phenomena such as vortex and acoustic wave propagation. The answer is naturally dependent upon the choice of numerical scheme,[2] but it is also influenced by the modal content of the fluid dynamics. Specifically, this study looks at high-order and optimized spatial stencils and their associated dispersion and dissipation characteristics coupled with several time integration schemes. Scheme stabilization is also addressed with respect to artificial dissipation and filtering techniques. [3] The theoretical investigations based on von Neumann analysis are substantiated by calculations of pure mode and multiple mode wave propagation problems, isentropic vortex propagation and the DNS of Taylor Green vortex transition, all of which are used to establish the accuracy properties of the schemes.

[1]Distribution A: Approved for public release, distribution unlimited. Supported by AFOSR (PM: Drs. F. Fahroo and Chiping Li)
[2]Zingg, **SIAM J. Sci. Comput.**, 22, 476-502, 2000
[3]Edoh, Karagozian, Merkle and Sankaran, AIAA 2015-0284

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