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Inviscid Wall-Modeled Large Eddy Simulations for Improved Efficiency[1] KURT AIKENS, KYLE CRAFT, ANDREW REDMAN, Houghton College — The accuracy of an inviscid flow assumption for wall-modeled large eddy simulations (LES) is examined because of its ability to reduce simulation costs. This assumption is not generally applicable for wall-bounded flows due to the high velocity gradients found near walls. In wall-modeled LES, however, neither the viscous near-wall region or the viscous length scales in the outer flow are resolved. Therefore, the viscous terms in the Navier-Stokes equations have little impact on the resolved flowfield. Zero pressure gradient flat plate boundary layer results are presented for both viscous and inviscid simulations using a wall model developed previously.[2] The results are very similar and compare favorably to those from another wall model methodology[3] and experimental data. Furthermore, the inviscid assumption reduces simulation costs by about 25% and 39% for supersonic and subsonic flows, respectively. Future research directions are discussed as are preliminary efforts to extend the wall model to include the effects of unresolved wall roughness.

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[2]K. M. Aikens, "High-fidelity large eddy simulation for supersonic jet noise prediction," Ph.D. thesis, Purdue University, 2014.
[3]S. Kawai and J. Larsson, Phys. Fluids **24**, 015105 (2012).

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