

Abstract Submitted
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Progress Towards an LES Wall Model Including Unresolved Roughness¹ KYLE CRAFT, ANDREW REDMAN, KURT AIKENS, Houghton College — Wall models used in large eddy simulations (LES) are often based on theories for hydraulically smooth walls. While this is reasonable for many applications, there are also many where the impact of surface roughness is important. A previously developed wall model² has been used primarily for jet engine aeroacoustics. However, jet simulations have not accurately captured thick initial shear layers found in some experimental data.³ This may partly be due to nozzle wall roughness used in the experiments to promote turbulent boundary layers. As a result, the wall model is extended to include the effects of unresolved wall roughness through appropriate alterations to the log-law. The methodology is tested for incompressible flat plate boundary layers with different surface roughness. Correct trends are noted for the impact of surface roughness on the velocity profile. However, velocity deficit profiles and the Reynolds stresses do not collapse as well as expected. Possible reasons for the discrepancies as well as future work will be presented.

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²K. M. Aikens, “High-fidelity large eddy simulation for supersonic jet noise prediction,” Ph.D. thesis, Purdue University, 2014.

³R. W. Powers, C.W. Kuo and D. K. McLaughlin, AIAA Paper No. 2013-2186, 2013 (unpublished).

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