

Abstract Submitted
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Wall-Roughness Eddy Viscosity for RANS Closures¹ GILES BRERETON, JUNLIN YUAN, Michigan State University — In turbulent boundary layers over rough walls, a triple decomposition of variables into mean, spatially varying, and fluctuating components, together with a double-averaging procedure, can be used to identify extra terms in the x -momentum equation which describe the pressure and viscous drag forces per unit mass *on account of roughness*. These terms, which are significant only in the roughness sublayer, have been measured in the DNS of Yuan & Piomelli (2014). In this talk, we describe a model for the effects of these terms as if they make an additive contribution to the eddy viscosity within the roughness sublayer, by recasting them as a simple algebraic function of the dimensionless roughness scale k_s^+ , for which a theoretical rationale is proposed. With this modification, k - ϵ and k - ϵ - $v'v'$ - f closures for turbulent channel flow yield mean velocity profiles and friction factors which are in good agreement with measured data in rough-wall duct flows over a wide range of values of k_s^+ and Re.

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