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Modeling roughness effects in turbulent boundary layers using elliptic relaxation[1] JACOB GEORGE, Innovative Aerospace Solutions, Downey, CA, ALEJANDRO DE SIMONE, GIANLUCA IACCARINO, Center for Turbulence Research (CTR), Stanford University, Stanford, CA, JAVIER JIMENEZ, School of Aeronautics, U. Politecnica, Madrid, Spain, also CTR, Stanford — We present results from the efforts towards modeling roughness in turbulent boundary layers using elliptic relaxation. This scheme, included in the $v^2 - f$ model and first formulated by Durbin (1993, JFM, vol. 249, p.465) for smooth-walls, uses an elliptic partial differential equation to incorporate near-wall turbulence anisotropy and non-local pressure-strain effects. The use of the elliptic PDE is extended to model roughness effects in various transitionally-rough and fully-rough boundary layers consisting of a uniform and sparse distribution of cylinders for which experimental data is available. The roughness effects are incorporated through the elliptic PDE by including the length and time scales that the roughness imposes upon the flow, which the experiment has shown to be constant within the rough-walls. Further modeling of roughness effects is considered by altering the source terms in the elliptic PDE.

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