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Simulation Wall-Bounded Turbulent Flows with Linear Effective Viscosity Models: Drag Reduction and New Mechanistic Insight R. WANG, C-F. LI, Y.-C. PAN, Jiangsu University, P.R. China, B. KHOMAMI, University of Tennessee, Knoxville — The efficacy of linear effective viscosity models in predicting the multi-stage transition between the onset of drag reduction and the maximum drag reduction (MDR) asymptote in wall-bounded turbulent flows has been examined. Our Reynolds stress model based computations demonstrate the ability of this class of models to not only predict drag reduction but also capture important characteristics of turbulent drag reduced flows such as the mean velocity profile, root-mean-square velocity fluctuations, Reynolds stress and viscous stress profiles. Specifically, enhancement of the slope of the effective viscosity model gives rise to enhanced drag reduction up to the maximum drag reduction asymptote. Moreover, manipulation of the effective viscosity profile in the channel allows determination of the region of the flow that plays a central role in the multi-stage transition between the onset of drag reduction and MDR. Specifically, we have observed that in the low drag reduction (LDR) regime this region is confined to 100 wall units from the wall, while in high drag reduction (HDR) and MDR regimes this region is enlarged to 200 or more wall units.

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