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Analysis of the Mean Momentum Balance in Polymer Drag Reduced Turbulent Boundary Layers[1] CHRISTOPHER WHITE, MATT BLAKE[2], JOE KLEWICKI, University of New Hampshire, YVES DUBIEF, University of Vermont — Mean momentum balances (MMB) in polymer drag reduced turbulent channel and zero-pressure gradient boundary layer flows are examined using experimental and numerical data available in the literature. For each data set, three flow cases are examined: Newtonian, low drag reduction (LDR), and high drag reduction (HDR). The Newtonian case is used as a baseline for comparison, while LDR and HDR flows are chosen since turbulent statistics trend differently between LDR and HDR flows. The results show that important qualitative features of the layer structure that exists for flows of a Newtonian fluid exist for flows of drag reducing polymer solutions. However, with increasing drag reduction: the stress gradient balance layer extends further from the wall, the Reynolds stress gradient contribution to the MMB decreases, and the polymer stress gradient contribution to the MMB increases. The latter finding demonstrates that polymers have a significant effect on the mean dynamics of HDR flows.

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