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**Laminar and turbulent comparisons for channel flow and flow control** IVAN MARUSIC, DANIEL JOSEPH, KRISHNAN MAHESH, University of Minnesota — A formula is derived that shows just how much the discrepancy between the volume flux of laminar and turbulent flow at the same pressure gradient increases as the pressure gradient is increased. We compare laminar and turbulent flows in channels with and without flow control. For the related problem of a fixed bulk Reynolds number flow, we seek the theoretical lowest bound for skin-friction drag for control schemes that use surface blowing and suction with zero-net volume-flux addition. For one such case, using a cross-flow approach, we show that sustained drag below that of the laminar Poiseuille flow case is not possible. For more general control strategies we derive a criterion for achieving sub-laminar drag, and use this to consider the implications for the control strategy design and the limitations at high Reynolds numbers.

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