Analytic prediction for planar turbulent boundary layers ZHEN-SU SHE, XI CHEN, College of Engineering, Peking University — Analytic predictions of mean velocity profile (MVP) and streamwise (x) development of related integral quantities are presented for flows in channel and turbulent boundary layer (TBL), based on a symmetry analysis of eddy length and total stress. Specific predictions include the relations for momentum Reynolds number (Re_θ) with friction Re_τ and streamwise Re_x: $Re_\theta \approx 3.27 Re_\tau$ and $Re_x/Re_\theta = 4.94[(\ln Re_\theta + 1.88)^2 + 1]$; the streamwise development of the friction velocity u_τ: $U_e/u_\tau \approx 2.22 \ln Re_x + 2.86 - 3.83 \ln(\ln Re_x)$, and of the boundary layer thickness δ_e: $x/\delta_e \approx 7.27 \ln Re_x - 5.18 - 12.52 \ln(\ln Re_x)$, which are fully validated by recent reliable data.

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