Abstract Submitted
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Asymptotic Analysis of the Constant Pressure Turbulent Boundary Layer THOMAS LUNDGREN — Following Mellor (1972), the Navier-Stokes equations are expanded in the small parameter $\epsilon(= u_\tau/U_\infty)$ which is determined as a function of Reynolds number by the matching process. The present analysis differs from previous ones by employing the complete unsteady NS equations instead of the unclosed mean equations. The result is an overlap logarithmic inertial range with time dependent additive constants. The specific results are (with $X = x/\delta, Y = y/\delta, Z = z/\delta, T = U_\infty t/\delta$): $u/U_\infty = 1 + \epsilon(\kappa^{-1}\ln(Y) + B_0(X - T, Z)); v/U_\infty = \epsilon A_0(X - T, Z); w/U_\infty = \epsilon C_0(X - T, Z)$, where A_0, B_0, C_0 are random functions of T when X, Z are fixed, and $\epsilon = \kappa/\ln(\epsilon R_e b), b = cst$ determines the wall friction in terms of the Reynolds number in the usual way. Note that the logarithmic part is steady. B.Lindgren et al (PF **16**,2004) have shown experimentally that the fluctuations of u about the mean, i.e. $B_0 - < B_0 >$, is approximately Gaussian and independent of y in the log layer.

Thomas Lundgren
University of Minnesota

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