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The diagnostic plot - a new way to appraise turbulent boundary layer data P.H. ALFREDSSON, R. OERLUE, Linne FLOW Centre, KTH Mechanics — Most turbulent boundary layer data are obtained with hot-wire anemometry which gives access both to the mean (U) and turbulence intensity (u') distributions of the streamwise velocity. Comparisons between different measurements strongly depend on the accuracy of the determination of the friction velocity (u_τ) and for comparisons in the near wall region the determination of the wall position is crucial. If u' is plotted as function of U, where both quantities are normalized by the free stream velocity (U_∞) (hereafter called the *diagnostic plot*), any uncertainties in the wall position and u_τ are avoided when comparing different cases. For a given Re all such distributions should fall on top of each other if u' and U are accurately measured and the measurements are made in standard zero pressure gradient turbulent boundary layers. Close to the wall ($y^+ < 10$) the distribution is nearly self similar and independent of Re. Moreover the distribution should be linear with a constant slope (~ 0.40) up to, at least, $y^+ = 3$ (corresponding to $U/U_\infty > 0.1$ for typical laboratory experiments) and thereafter the slope should decrease. The diagnostic plot clearly indicates at what position the measured values show a wall interference effect. Also in the outer region the distributions at different Reynolds numbers overlap, and the diagnostic plot has the interesting property that both the inner ($y^+ < 10$) and outer regions can be made to collapse in the same plot.

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