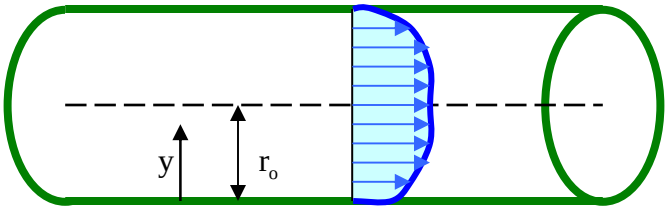
ME 637 **HW Set 4**

1) For a pipe of radius r_o show that

$$-\overline{u'v'} + \nu\frac{dU}{dy} = u^{*2}\left(1 - \frac{y}{r_o}\right)$$



2) For Rannie's eddy viscosity model, $\frac{\nu_T}{\nu} = \sinh^2 k_1 y^+$. Show that the corresponding mean velocity field is given by $U^+ = \frac{1}{k_1}\tanh\left(k_1 y^+\right)$.

3) Show that the mixing length model follows from the assumption of local equilibrium (production = dissipation). (Hint: $\nu_T = k^{\frac{1}{2}}\ell$, $-\overline{u'v'} \approx C_D{}^{1/2}k$).

4) Develop a two-equation type model for the mean and mean-square temperature fluctuation in a boundary layer flow. (Hint: follow the steps similar to those for $k-\varepsilon$ model.)