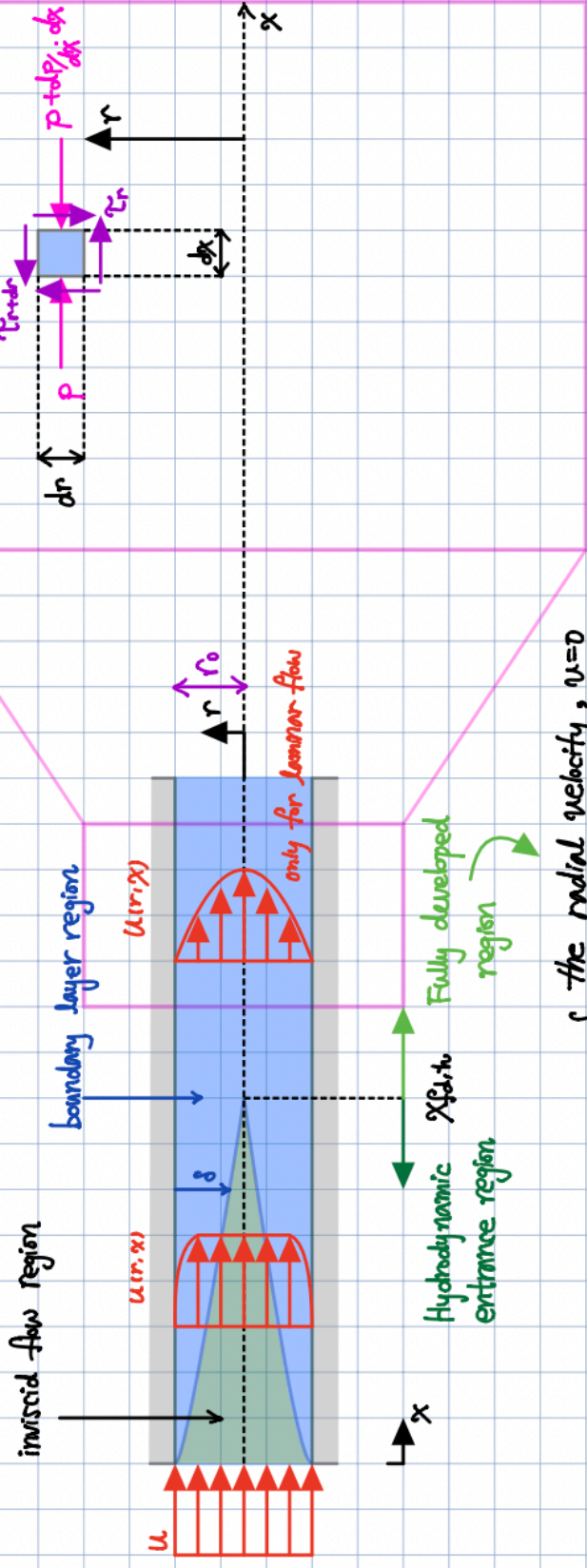


Velocity Profile in the Fully Developed Region



the radial velocity, $u_r = 0$
 $\frac{\partial u}{\partial x} = 0 \rightarrow u = u(r,x) = u(r)$

Equilibrium

$\sum F_x = 0$;

$\tau_r \cdot A_1 - \tau_r \cdot dA_2 + p_x \cdot A_2 - p_{x+dx} \cdot A_2 = 0$

$\tau_r \cdot A_1 - (\tau_r + \frac{\partial \tau_r}{\partial r} \cdot dr) \cdot A_1 + p \cdot A_2 - (p + \frac{\partial p}{\partial x} \cdot dx) \cdot A_2 = 0$

$A_1 = 2\pi r \cdot dx$, $A_2 = 2\pi r \cdot dr$

$\tau_r \cdot (2\pi r \cdot dx) - \left\{ \tau_r \cdot (2\pi r \cdot dx) + \frac{\partial \tau_r}{\partial r} \cdot dr \cdot (2\pi r \cdot dx) \right\}$

$+ p \cdot (2\pi r \cdot dr) - \left\{ p \cdot (2\pi r \cdot dr) + \frac{\partial p}{\partial x} \cdot dx \cdot (2\pi r \cdot dr) \right\} = 0$

