Dimensionless Groups

$$Re = \frac{UD}{\nu} = \frac{D^2/\nu}{D/U} = \frac{\text{Inertial}}{\text{Viscous}}$$

$$Pr = \frac{\nu}{\alpha}$$

$$Pe \equiv Re\,Pr = \frac{UD}{\alpha}$$

$$Nu \equiv \frac{hD}{k} = \frac{h}{(k/D)}$$

$$Bi \equiv \frac{hR}{k}$$

$$f_f \equiv \frac{\tau_w}{\frac{1}{2}\rho U_\infty^2}$$

$$St \equiv \frac{h}{\rho U_\infty \hat{C}_p} \equiv \frac{Nu}{Re\,Pr}$$

$$j_H = St\,Pr^{2/3} \quad \text{Colburn Analogy} \approx f_f/2$$

$$h \approx \rho U_\infty \hat{C}_p \frac{f_f}{2} Pr^{-2/3}$$

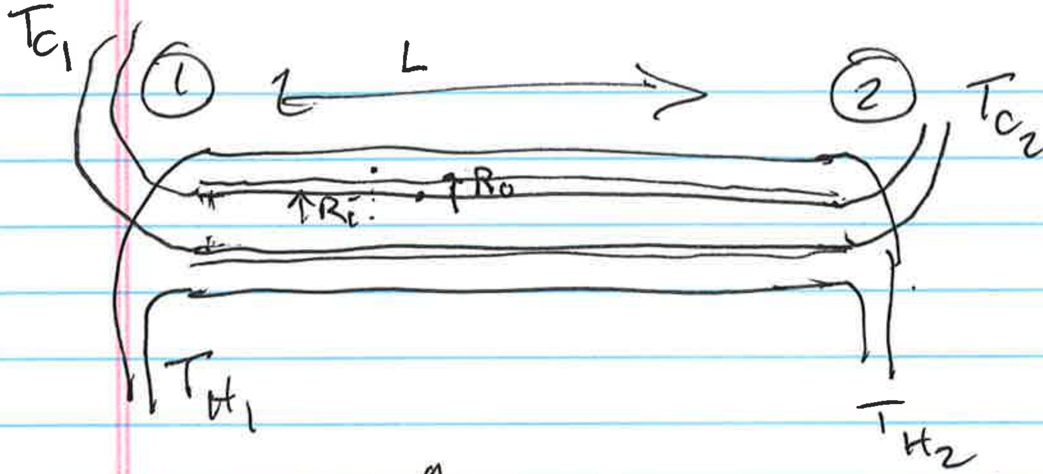
$$\left(\frac{\omega a^2}{\nu}\right)^{1/2} \equiv \text{Womersley } \# = \left(\frac{a}{\nu/\omega}\right)^{1/2}$$

$$Ra = \frac{\beta g \Delta T D^3}{\nu \alpha} \equiv Gr\,Pr$$

$$Gr = \frac{\beta g \Delta T D^3}{\nu^2}$$

$$Sc \equiv \frac{\nu}{D_{AB}}$$

$$J_H = J_D \equiv \frac{k_m}{D_{AB}} Sc^{2/3}$$



$$C_H = \dot{m}_H \hat{C}_{pH} \qquad C_c = \dot{m}_c \hat{C}_{pc}$$

$$Q = UA \, \Delta T_{lm}$$

$$\Delta T_{lm} = \frac{\Delta T_1 - \Delta T_2}{\ln\left(\frac{\Delta T_1}{\Delta T_2}\right)} \qquad \Delta T = T_H - T_C$$

$$UA = \left[\frac{1}{h_i 2\pi R_i L} + \frac{\ln(R_o/R_i)}{2\pi k_m L} + \frac{1}{h_o 2\pi R_o L} \right]^{-1}$$

$$Q = C_H (T_{H_2} - T_{H_1})$$

$$= C_c (T_{C_2} - T_{C_1})$$