MICRO-SCOPIC BALS

MOMENTUM

$\underline{v}(t,x,y,z)$

velocity profile

$$\rho\left(\frac{\partial \underline{v}}{\partial t} + \underline{v}\cdot\nabla\underline{v}\right) = -\nabla p + \mu\nabla^2\underline{v} + \rho\underline{g}$$

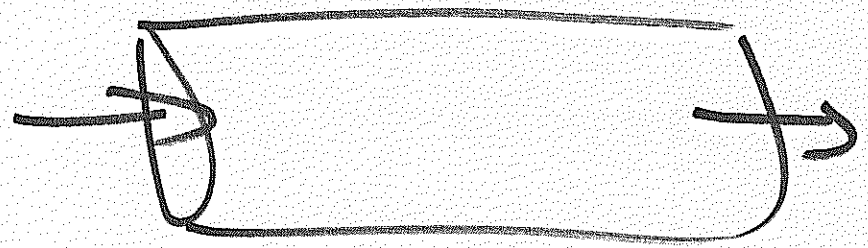
HEAT

$T(t,x,y,z)$

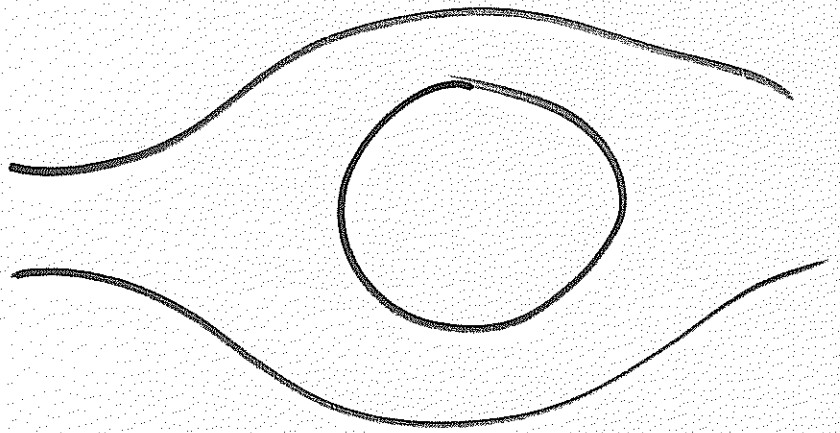
temp profile

$$\frac{\partial T}{\partial t} + \underline{v}\cdot\nabla T = \frac{k}{\rho c_p}\nabla^2 T + \frac{\hat{S}}{\rho c_p}$$

MOMENTUM

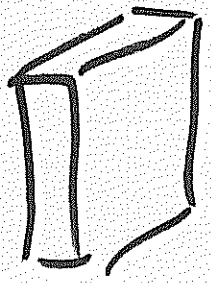


Laminar
Turbulent



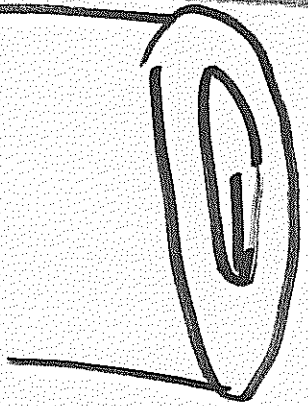
creeping flow
turbulent

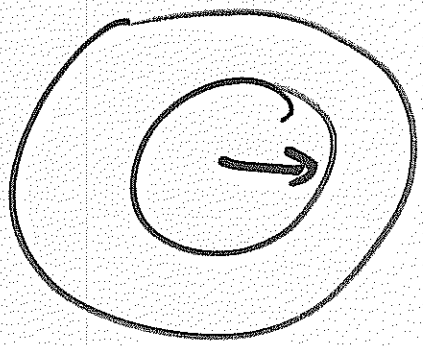
HEAT



$$\frac{q}{A} = C_1$$

$$T = -\frac{C_1}{k}x + C_2$$





$$\frac{q_r}{A} = \frac{C_1}{r}$$

$$T = (\quad)\ln r + C_2$$

MISC TOPICS

Momentum

hydraulic diameter

Ergun Eqn

HAGEN POISEUILLE

NEWTON'S LAW of VISCOSITY

$$\tau_{21} = -\mu \frac{dV_1}{dX_2}$$

MEB

MACRO MOMENTUM

HEAT

SHELL + TUBE

H. E. EFFECTIVE-NESS

HEAT XFER COEF

RADIATION (hr, Heatshields)

FOURIER'S LAW OF HEAT CONT

$$\frac{Q_x}{A} = -k \frac{dT}{dx}$$

Newton's Law of cooling

Momentum (cont.)

Heat (cont.)

MACRO E-BAL