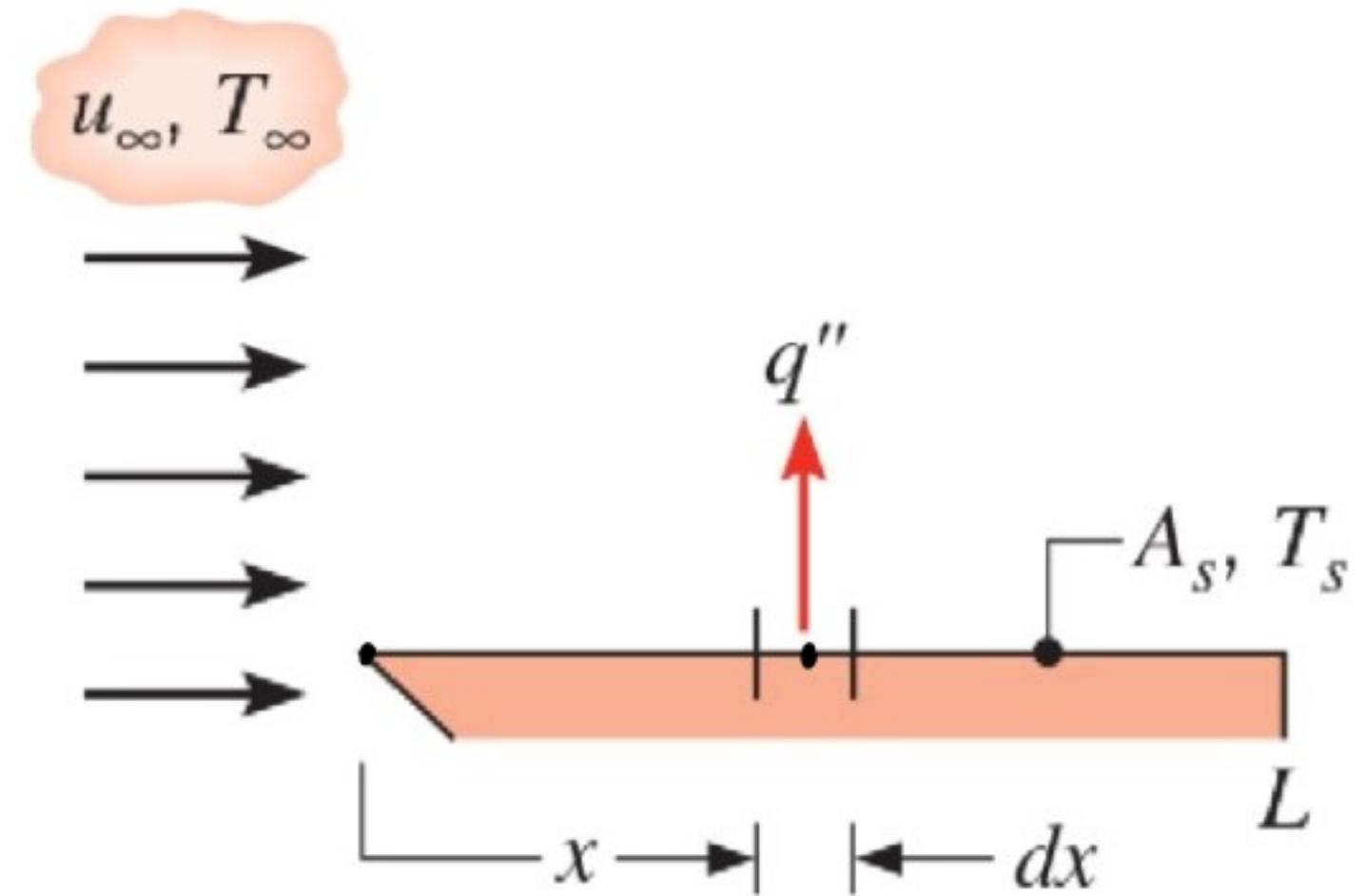
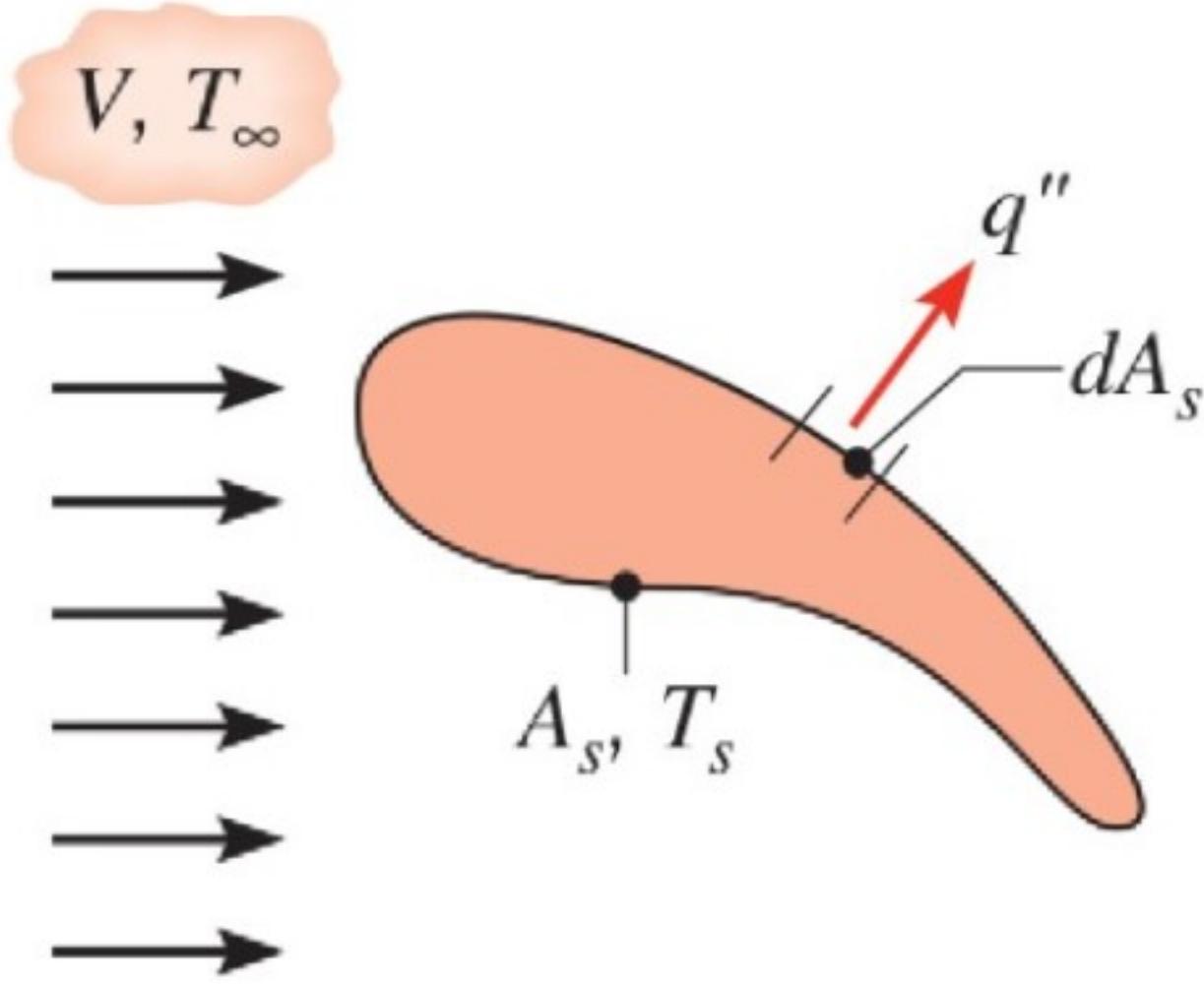


Local and Average Convection



$$q = \int_{A_s} q'' dA_s$$

$$q = (T_s - T_\infty) \int_{A_s} h dA_s$$

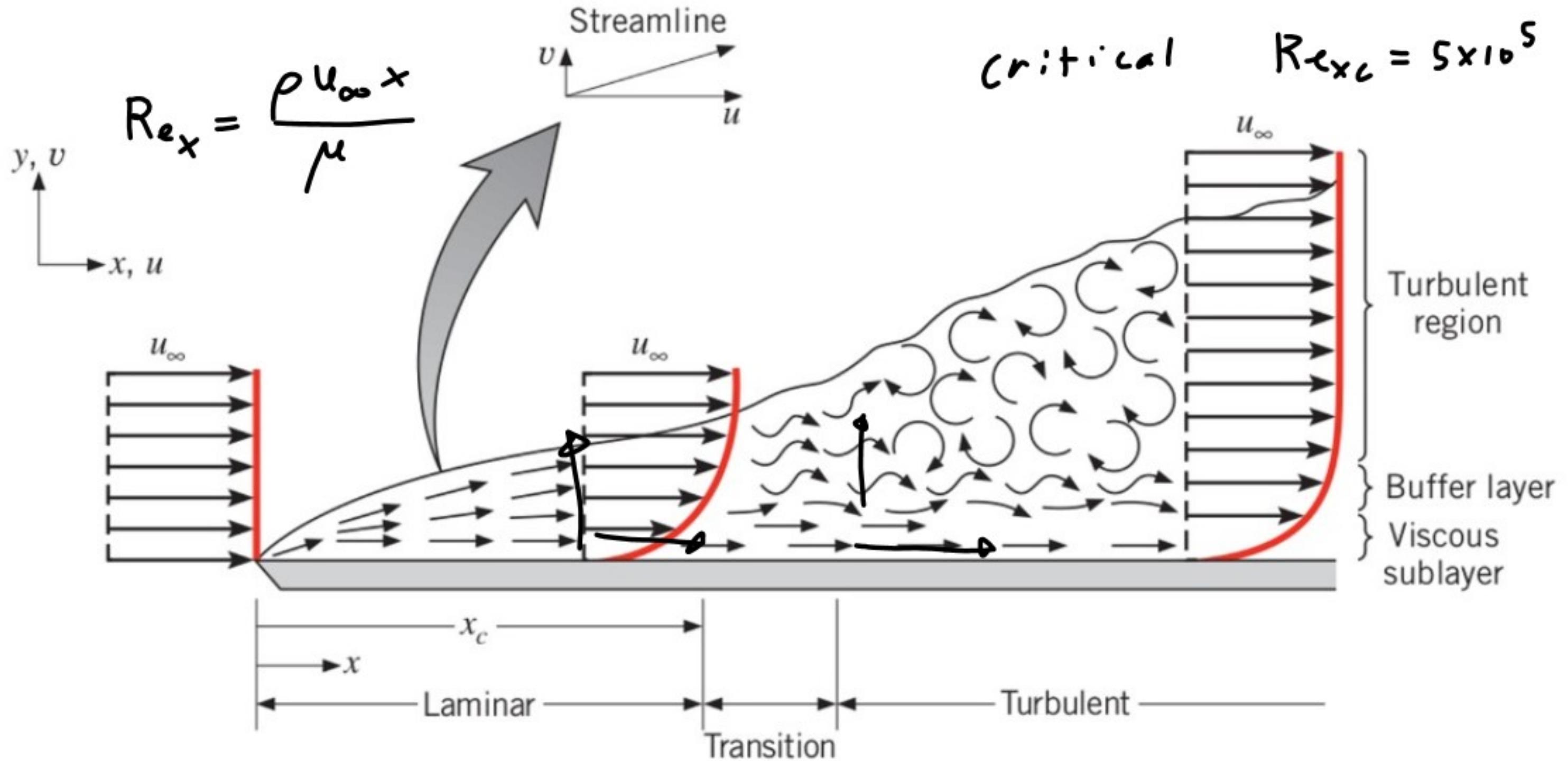
$$q = \bar{h} A_s (T_s - T_\infty)$$

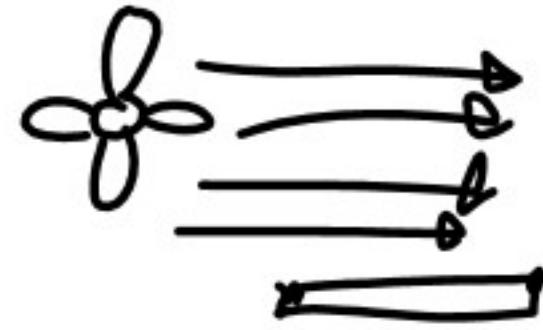
$$\boxed{\bar{h} = \frac{1}{A_s} \int_{A_s} h dA_s}$$

For flat plate

$$\bar{h} = \frac{1}{L} \int_0^L h(x) dx$$

Laminar and Turbulent flow

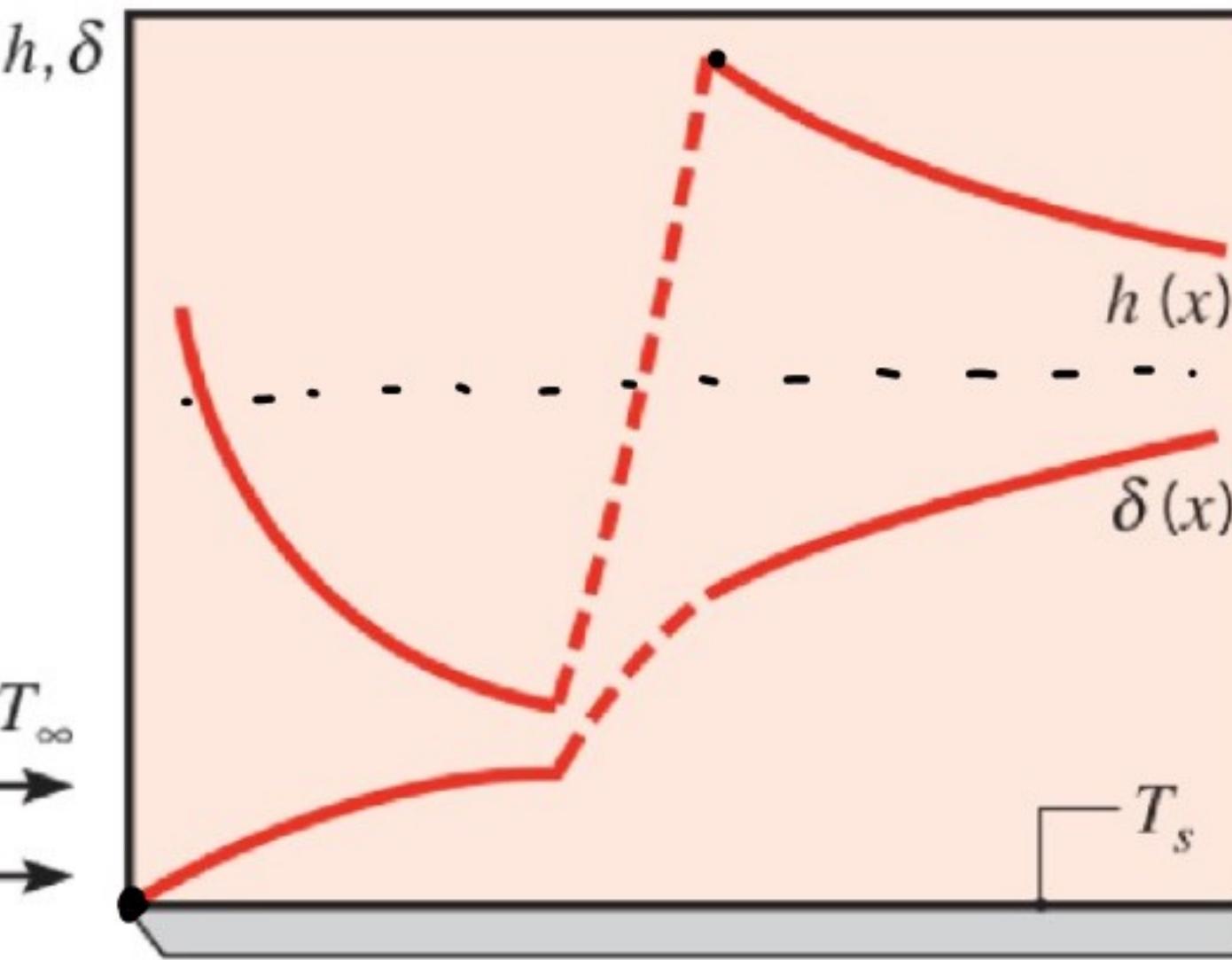




CPV

u_{∞}, T_{∞}

Two horizontal arrows pointing from the left towards a flat plate, representing the free-stream conditions u_{∞} and T_{∞} .



x_c

x

Laminar

Transition

Turbulent

A horizontal axis labeled x with two vertical lines. The first vertical line is labeled x_c and marks the transition from laminar to turbulent flow. The second vertical line marks the trailing edge of the plate. The region between the leading edge and x_c is labeled "Laminar". The region between x_c and the trailing edge is labeled "Transition". The region beyond the trailing edge is labeled "Turbulent".

Equations

$$\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} = 0$$

Conservation or Mass

$$u \frac{\partial u}{\partial x} + v \frac{\partial u}{\partial y} = -\frac{1}{\rho} \frac{dp_{\infty}}{dx} + v \frac{\partial^2 u}{\partial y^2}$$

Momentum

$$u \frac{\partial T}{\partial x} + v \frac{\partial T}{\partial y} = \alpha \frac{\partial^2 T}{\partial y^2} + \frac{v}{C_p} \left(\frac{\partial u}{\partial y} \right)^2$$

Energy

advection

y axis
conduction

viscous
dissipation