RECAP 5.1: CV form of mass conservation and energy balance.

Open system

\[ \frac{dN}{dt} \text{ _sys} = \frac{dN}{dt} \text{ _cv} + \text{net rate of outflow of } N \text{ across CS} \]

RTT:

\[ \frac{dN}{dt} \text{ _sys} = \frac{dN}{dt} \text{ _cv} + \text{net rate of outflow of } N \text{ across CS} \]

Conservation of mass:

\[ \frac{dm_{cv}}{dt} - \text{m}_\text{in} + \text{m}_\text{out} = 0 \]

where \( \text{m} = \int_{cs} \rho \cdot V \cdot dA \) (mass flow rate)

Conservation of energy:

\[ \frac{dE_{cv}}{dt} + \text{net rate of outflow of energy across CS} = \dot{Q} - (W_f + W_s) \]

where:

\( W_f = \int_{cs} \frac{P}{\rho} \cdot \rho \cdot V \cdot dA \)