The Energy Balance
(Transient Analysis)

►**Integrate** energy rate balance (**Eq. 4.15**), ignoring the effects of kinetic and potential energy, from time **0** to a final time *t*.

$$\int_0^t \left(\frac{dE_{cv}}{dt}\right) dt = \int_0^t \dot{Q}_{cv}\, dt - \int_0^t \dot{W}_{cv}\, dt + \int_0^t \left(\sum_i \dot{m}_i h_i\right) dt - \int_0^t \left(\sum_e \dot{m}_e h_e\right) dt$$

When the specific enthalpies at inlets and exits are constant with time, this becomes

$$E_{cv}(t) - E_{cv}(0) = Q_{cv} - W_{cv} + \sum_i m_i h_i - \sum_e m_e h_e \qquad \textbf{(Eq. 4.25)}$$