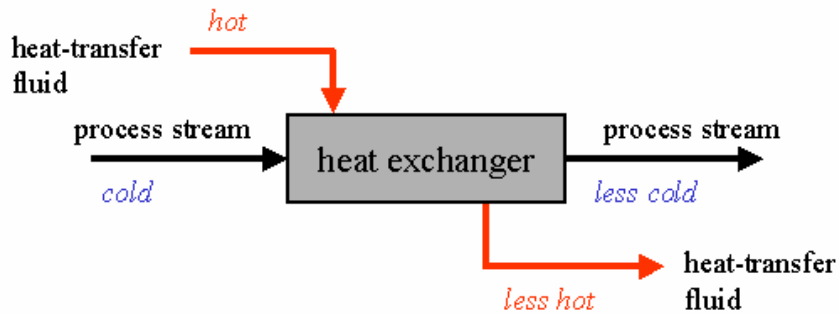


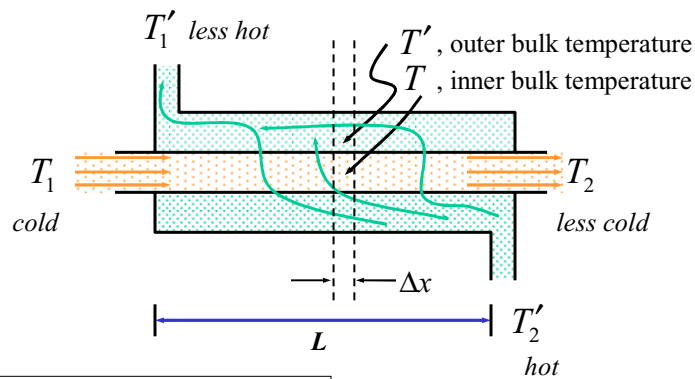
Is overall heat-transfer coefficient a useful concept for analyzing heat exchangers?



What ΔT do we use?

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The Simplest Heat Exchanger:
Double-Pipe Heat exchanger - counter current



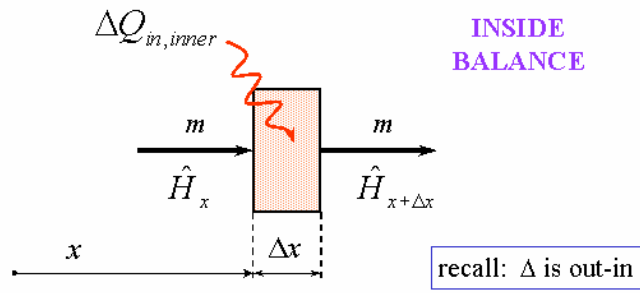
We will do an open-system energy balance on a differential section to determine the correct average temperature difference to use.

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Open system energy balance on a differential control volume

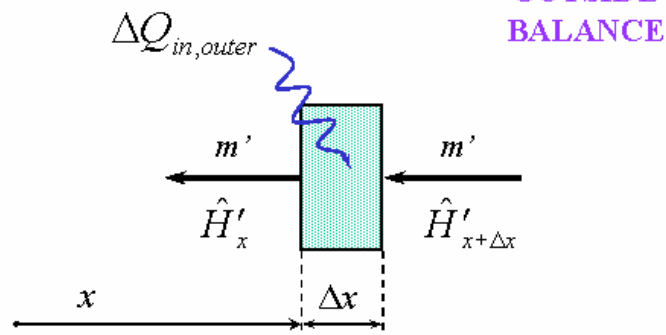
$$\cancel{\Delta E_p} + \cancel{\Delta E_k} + \Delta H = \cancel{Q_{in}} + \cancel{W_{s,on}}$$

$$\Delta H = Q_{in}$$



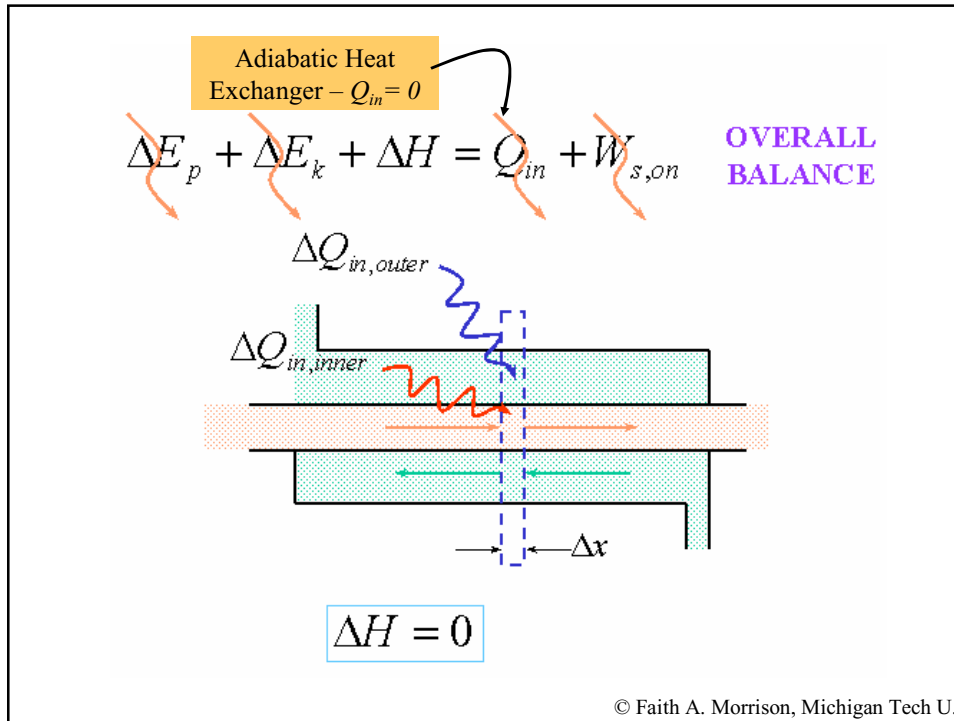
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$$\Delta H = Q_{in}$$



recall: Δ is out-in

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energy balance on overall differential system $\Delta H = 0$

$$= \Delta H_{inner\ system} + \Delta H_{outer\ system}$$

$$= \underbrace{\Delta Q_{in,inner}}_{\text{heat into inner differential system}} + \underbrace{\Delta Q_{in,outer}}_{\text{heat into outer differential system}} = 0$$

divide by Δx and take the limit as Δx goes to zero:

$$\left(\frac{dQ_{in,inner}}{dx} \right) = - \left(\frac{dQ_{in,outer}}{dx} \right)$$

$$\equiv \frac{dQ_{in}}{dx}$$

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