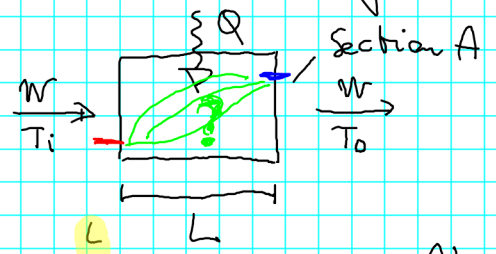
15/05/2019

1

State variable for flowing thermal elements

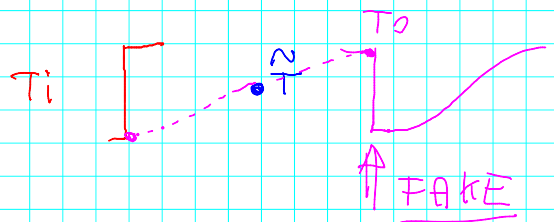


$$\mathcal{E}(t) = \int_0^L c_p T(\alpha, t)\, \rho A\, d\alpha = \tilde{T} \cdot c_p M$$

⇑ Who is this guy?

2 Suppose $\tilde{T} = \frac{T_i + T_o}{2}$

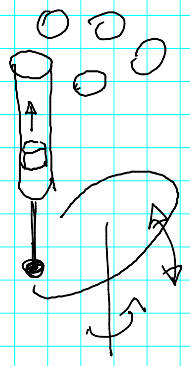
↑ state variable ⇒ NO JUMP !!



↑ FAKE undershoot

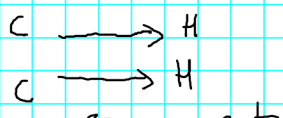
Hence we take $\tilde{T} = T_o$

But we need to know the sign (direction) of $\dot{m}$

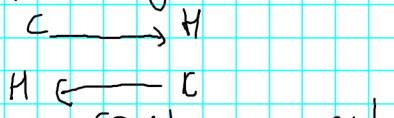


pbte
angle ⇒ piston stroke ⇒ flowrate

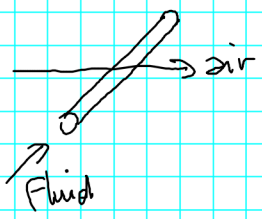
Heat exchanger: two streams of Fluid, a wall separating them



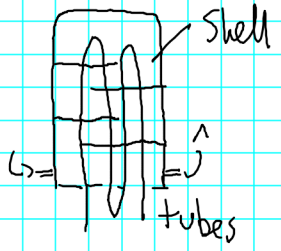
co-current



counter-current



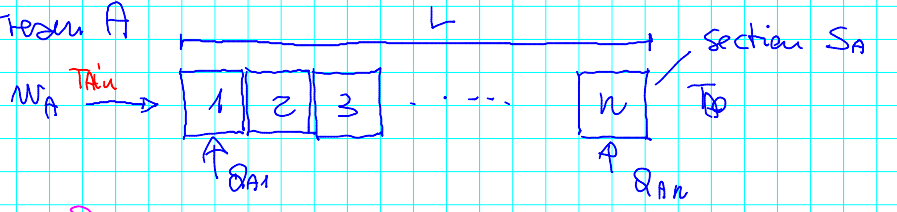
counter-cross



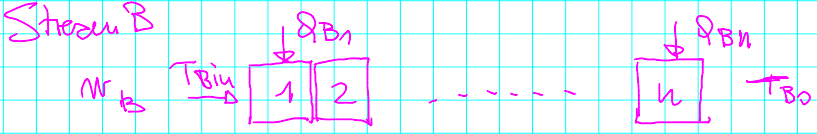
shell-tube

FINITE-VOLUME APPROACH (known flow direction)

5 Stream A



Stream B

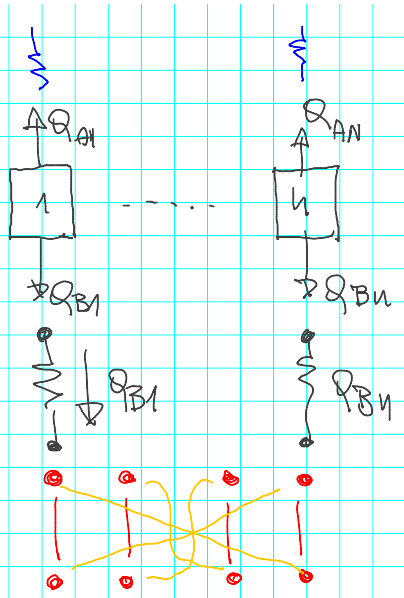


$$\rho_A c_A S_A \frac{L}{n} \frac{d T_{Ai}}{dt} = W_A c_A T_{Ai-1} - W_A c_A T_{Ai} + Q_{Ai}, \quad T_{Ao} = T_n$$

T_{Ain} if $i = 1$

Analogous

6 Wall :



$$c_W \rho_W V_{Wi} \frac{d T_{Wi}}{dt} = -Q_{Ai} - Q_{Bi}$$

Wall-Fluid exchange

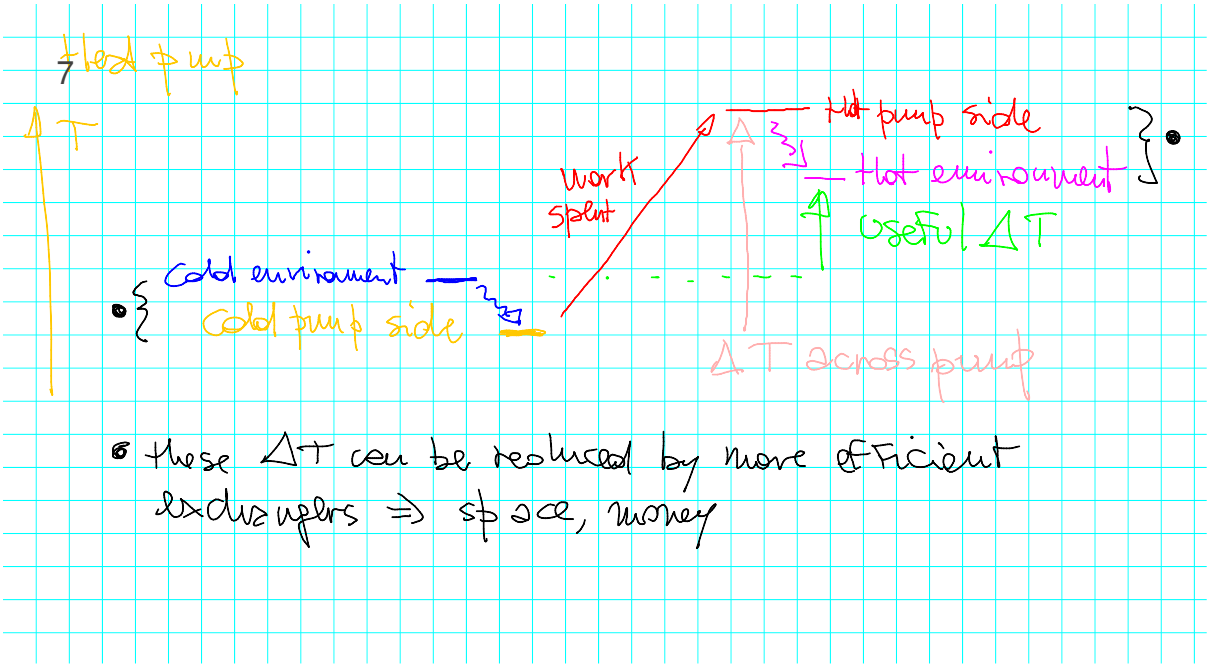
$$Q_{Bi} = G_{Bi} (T_{Wi} - T_{Bi})$$

convection element

Co-current

Counter-current

$\underline{\underline{A}}$ side analogous



- these ΔT can be reduced by more efficient exchangers $\Rightarrow$ space, money

containment elements

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