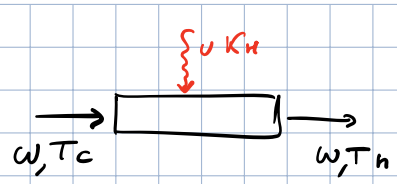
HEATER CONTROL



$$cp\ \rho\ V\ \dot{T}h = K_H\ \upsilon + w\,cp\,(T_c - T_h)$$

$$\left[\frac{J}{Kg\,K}\ \frac{Kg}{m^3}\ m^3\ \frac{K}{s}\right] = [W] + \left[\frac{Kg}{s}\ \frac{J}{Kg\,K}\ K\right] \quad \checkmark$$

$$V = L\,\pi\,\frac{(D_i)^2}{4}$$

$$10\ m\ \frac{(0.05\ m)^2}{4}\cdot\pi$$

$$s\,cp\,\rho V\,Th = \upsilon K_H + w\,cp\,T_c - w\,cp\,Th$$

$$(s\,cp\,\rho V + w\,cp)\,Th = \upsilon K_H + w\,cp\,T_c$$

$$Th(s) = \frac{K_H}{s\,cp\,\rho V + w\,cp}\,\upsilon + \frac{w\,cp}{s\,cp\,\rho V + w\,cp}\,T_c$$

$$= \frac{K_H / w\,cp}{s\frac{cp\,\rho V}{w\,cp} + 1}\,\upsilon + \frac{1}{s\frac{\rho V}{w} + 1}\,T_c$$

$$= \frac{K_H / w\,cp}{s\frac{\rho V}{w} + 1} + \frac{1}{s\frac{\rho V}{w} + 1}\,T_c$$

$cp = 4186$ J/Kg K
$\rho = 1000$ Kg/m3
$L = 10$ m
$Di = 0.05$ m
$K_H = 10000$ W
$w = w_{nom} = 0.5$ Kg/s

PI

$$\frac{K}{\frac{\rho V}{w}}\,\frac{\left(s\frac{\rho V}{w} + 1\right)}{s}$$

$$w_c = \frac{K\ K_H / w\,cp}{\frac{\rho V}{w}}$$

$wc = 10000 \rightarrow$ Ti = 39,27
K = 0,0047