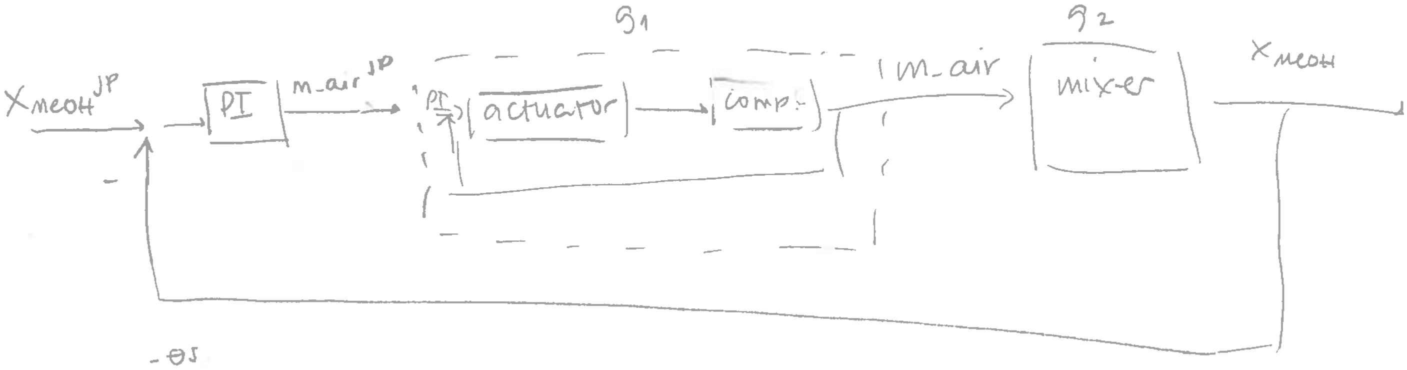
cascades

air



$g_1 \approx \frac{e^{-\theta s}}{\tau_c s+1}$ (SIMC)

$g_2 = $ mixer

gein $\Rightarrow \left.\frac{dx_{MeOH}}{dm_{air}}\right|^*$

$g_2 = \frac{K_2}{\tau_2 s+1}$

$x_{MeOH} = \frac{mol\,MeOH}{mol\,MeOH + mol\,air} = \frac{mol\,MeOH}{mol\,MeOH + \frac{m_{air}}{MW_{air}}}$

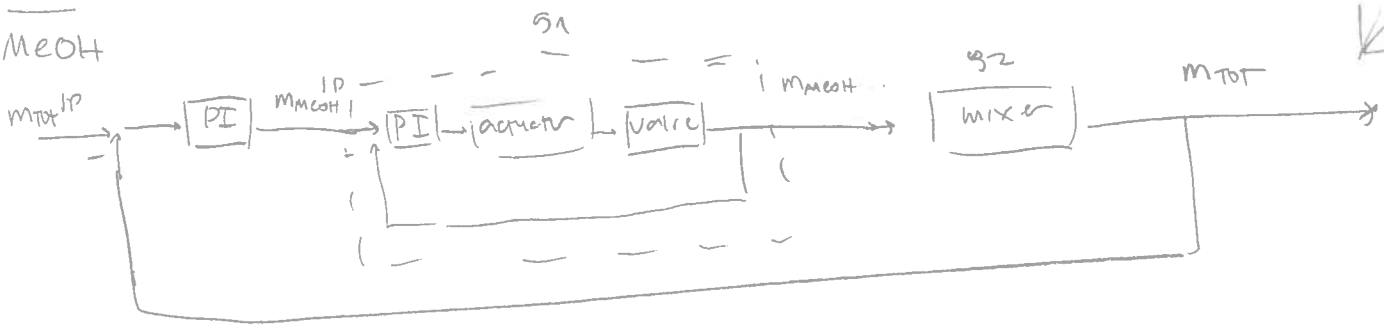
$x_{MeOH} = \frac{\dot{n}_{MeOH}}{\frac{\dot{n}_{MeOH}\cdot MW_{air} + m_{air}}{MW_{air}}} = \frac{(MW_{air})(\dot{n}_{MeOH})}{\dot{n}_{MeOH}\cdot MW_{air} + m_{air}}$

$\frac{dx_{MeOH}}{dm_{air}} = \frac{(m_{air}+\dot{n}_{MeOH}\cdot MW_{air})(0) - (MW_{air})(\dot{n}_{MeOH})(1)}{(\dot{n}_{MeOH}\cdot MW_{air} + m_{air})^2}$ $\Leftarrow K_2$ @ $t=0$

check vs. simulations

might be too high

MeOH

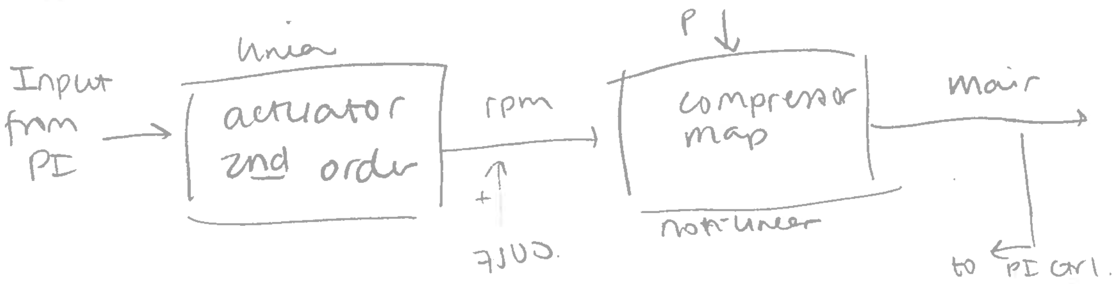


$m_{TOT} = m_{MeOH} + m_{air}$

$\frac{dm_{TOT}}{dm_{air}} = 1$

$g_2 = \frac{1}{\tau_2 s+1}$

$g_1 \approx \frac{e^{-\theta s}}{\tau_c s+1}$ (SIMC) compressor



want:

nominal: ≈0.87 capacity → 25970 kg/h

100% capacity ~ 30000 kg/h ~ 11800 rpm.

0.87 ~ 25920 ~ 9200 rpm

range

7500 − 11800 rpm

4300

0 → 4300

ada

for actuator

$$g = \frac{Ga}{\tau^2 s^2 + 2\tau\xi s + 1}$$

then, the transfer function for the actuator + compressor map is (approx) from input to actuator to mass flow -

with $\tau = 2$

$\xi = 1.2$

$K = 10797$ ← from step-test (can be calculated?)

28940 − 27861

$$g = \frac{1079.7}{(3.727s+1)(1.073s+1)}$$

$$g \approx \frac{10797 e^{-0.5s}}{(4.2s+1)}$$

$$K_c = \frac{1}{1079} \frac{4.2}{(1)}$$

ok with $\tau_c = 4\theta$

valve size: MeOH

$q_{valve} = C_v\, z \sqrt{\Delta p}$ (=) kg/h

want = @ $\Delta p = 0.5$

$z = 1$ $\quad$ $z = 0.7$

$q_{valve} = 4200$ $\quad$ $q = 2940$

so ⇒ $C_v = \dfrac{4200}{\sqrt{0.5}}$

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transfer function for ~~linear~~ valve with actuator

$$q_{valve} = \frac{C_v}{\tau^2 s^2 + 2\tau\zeta s + 1}$$

if $\tau = 1$

$\zeta = 1.1$ → overdamped.

$$P_{1,2} = \frac{-\zeta \pm \sqrt{\zeta^2 - 1}}{\tau}$$

$$q_{valve} = \frac{5939.7}{(0.6417s+1)(1.558s+1)}$$

$$q_{valve} \approx \frac{5939.7 e^{-0.32s}}{(1.8789s+1)}$$

good tuning with $\tau_c = 2\theta$

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compressor

(another page)

mixer

n = g/MW