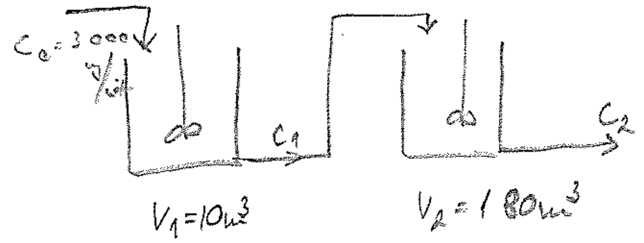
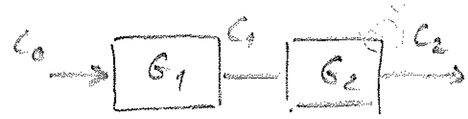
FIR számgyak ZH A csop

2013.

A/1 $\overline{W}=50\,m^3/h$

a) 



b) $$G_1=\frac{1}{\frac{V_1}{W}s+1}=\frac{1}{\frac{10m^3}{50m^3/h}}=\frac{1}{(0,2h)s+1}\ ;\ G_2=\frac{1}{\frac{180m^3}{50m^3/h}s+1}=\frac{1}{(3,6h)s+1}$$

c) Zavarás: ugrás $\hat{c}_0(\infty)=20000\,mg/lit-3000\,mg/lit=17.000\,mg/lit$

$$G_1=\frac{c_1}{c_0}=\frac{1}{(3,6h)s+1}\Rightarrow \text{Átmenetifv: } c_1(t)=\overline{c}_1+\hat{c}_1=\overline{c}_1+a\cdot k\left(1-e^{-\frac{t}{T_1}}\right)$$

$$c_1(t)=3000\,mg/lit+17000\,mg/lit\cdot 1\cdot\left(1-e^{-\frac{t}{0,2h}}\right)$$

$$7000=3000+17.000\left(1-e^{-\frac{t}{0,2}}\right)$$

$$\frac{4}{17}=1-e^{-\frac{t}{0,2}}$$

$$e^{-\frac{t}{0,2}}=0,764\Rightarrow t=0,054h\approx \underline{3,22\text{ perc}}$$

d) $$\frac{c_2}{c_0}=G_1G_2=\frac{1}{(0,2h)s+1}\cdot\frac{1}{(3,6h)s+1}$$

Átmenetifv:

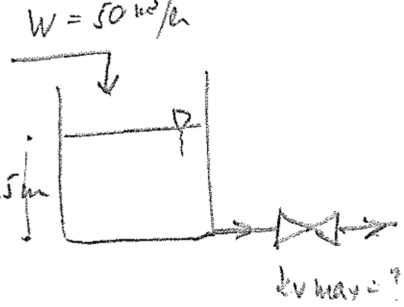
$$c_2(t)=\overline{c}_2+a\cdot k_1\cdot k_2\left[1-\frac{1}{T_1-T_2}\cdot\left(T_1e^{-t/T_1}-T_2e^{-t/T_2}\right)\right]\ ;\ t=3h$$

$$c_2(t)=3000\,mg/lit+17000\,mg/lit\cdot\left[1-\frac{1}{0,2-3,6}\left(0,2e^{-\frac{3}{0,2}}-3,6e^{-\frac{3}{3,6}}\right)\right]$$

$$=12297$$, tehát van

FIR számgyak #1 A csop

A/2



a) $\dfrac{W}{W_{max}} = \dfrac{H}{H_{max}} = 0,5 \Rightarrow W_{max} = 2 \cdot \bar{W}_m$

$= 100\ m^3/h$

$\Delta p_{st} = \varrho \cdot g\ \bar{H} = 1000\ kg/m^3 \cdot 9,81\ m/s^2 \cdot 1,5\ m$

$= 14\,715\ Pa$

$W_{max} = k_{vmax} \sqrt{\dfrac{\Delta p_{rel}}{\varrho_{rel}}} = k_{vmax} \dfrac{\sqrt{\dfrac{\Delta p_{st}}{1\ bar}}}{\sqrt{\varrho / 1000\ kg/m^3}}$

$100\ m^3/h = k_{vmax} \underbrace{\sqrt{0,1421}}_{0,3836}$

$\underline{k_{vmax} = 260\ m^3/h}$

b) $\dfrac{\bar{W}}{W_{max}} = \sqrt{\dfrac{H}{H_{max}}} = \sqrt{0,5}$

$W_{max} = \dfrac{\bar{W}}{\sqrt{0,5}} = 70\ m^3/h$

$70\ m^3/h = k_{vmax} \cdot 0,3836$

$k_{vmax} = \underline{182\ m^3/h}$

c) $\dfrac{\bar{W}}{W_{max}} = e^{0,5 \cdot 3 - 3} \Rightarrow W_{max} = \dfrac{50}{e^{(-1,5)}} = 224,08\ m^3/h$

$224,08\ m^3/h = k_{vmax} \cdot 0,3836 \Rightarrow k_{vmax} = \underline{584\ m^3/h}$

d) $W = 50\ m^3/h$

$k_v = 584\ m^3/h$

$\Delta p_{st} = 2m \cdot 1000\ kg/m^3 \cdot 9,81\ m/s^2 = 19620\ Pa = 0,1962\ bar$

$\Rightarrow W_{max} = k_{vmax} \cdot \sqrt{\dfrac{\Delta p_{rel}}{\varrho_{rel}}} = 584\ m^3/h\ \sqrt{0,1962} = 258,68\ m^3/h$

$\dfrac{W}{W_{max}} = e^{h\,3-3}$ $\Rightarrow$ $0,193 = e^{3h-3}$

$-1,64 = 3h - 3 \Rightarrow h = \underline{45\%}$

$\dfrac{50}{258,68} = e^{3h-3}$