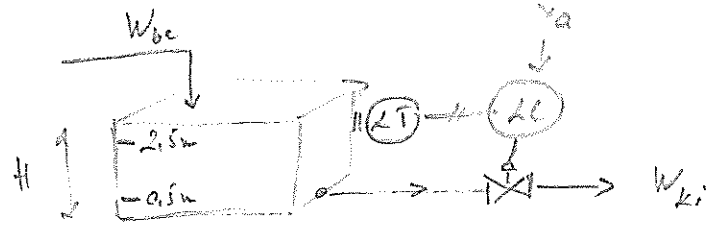
FIR számgyak 24 — 3 csop

2013

(1)



$\bar{W} = 50\ m^3/h$

$\bar{H} = 1,5\ m$

$\rho = 1150\ kg/m^3$

$A = 12 \times 5 = 60\ m^2$

$V = 180\ m^3$ $\Rightarrow H = 3m$

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

$k = 0,5$

$\Delta p_{st} = \rho \cdot g \cdot \bar{H} = 1150\ kg/m^3 \cdot 9,81\ m/s^2 \cdot 1,5\ m$

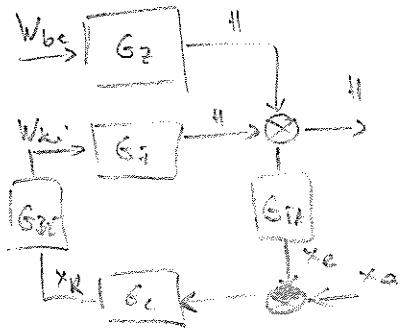
$= 0,1692\ bar$

$\frac{W}{W_{max}} = 0,5 \Rightarrow W_{max} = 100\ m^3/h$

$W_{max} = k_{vmax} \sqrt{\frac{\Delta p_{rel}}{\rho_{rel}}}$

$100\ m^3/h = k_{vmax} \sqrt{\frac{0,1692\ bar / 1\ bar}{1150\ kg/m^3 / 1000\ kg/m^3}}$

$k_{vmax} = 261\ m^3/h$



c) $G_z = \frac{H}{W_{be}} = \frac{\frac{2 \cdot \bar{H}}{\bar{W}_{be}}}{\frac{2 \cdot A \cdot \bar{H}}{\bar{W}_{be}} s + 1} =$

$= \frac{\frac{3\ m}{50\ m^3/h}}{\frac{180\ m^3}{50\ m^3/h} s + 1} = \frac{0,06\ h\ m^3/m^3}{(3,6\ h) s + 1}$

$G_7 = \frac{H}{W_{ki}} = \frac{0,06\ h\ m^3/m^3}{(3,6\ h) s + 1}$

$G_{7R} = \frac{x_e}{H} = \frac{100\% - 0\%}{2,5\ m - 0,5\ m} = 50\ \%/m$

$G_c \cdot A_{pc} = 1$

$G_{3E} = \frac{W_{ki}}{x_a} = \frac{W_{max} - 0\ m^3/h}{100\% - 0\%} = \frac{100\ m^3/h}{100\%} = 1\ m^3/h/\%$

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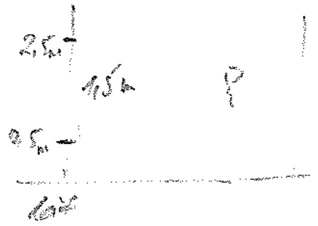
(1. felad)

d) $\bar{H} = 1{,}5\,m$



Ebből a TA 1m-t 100%

$$x_e = G_{TA} \cdot H = 50\frac{\%}{m} \cdot 1m = \underline{50\%}$$

e) Zavarás: ugrás $a = -10\,m^3/h$

$$G_2 = \frac{H}{W_{be}} = \frac{0{,}06\ m/(m^3/h)}{3{,}6h\ s + 1} \qquad \text{Átmeneti fv.:} \quad H(t) = \bar{H} + \hat{H}$$

$$H(t) = \bar{H} + a \cdot K\left(1 - e^{-t/T}\right) = 1{,}5m - 10\,m^3/h \cdot 0{,}06\frac{m}{m^3/h}\left(1 - e^{-\frac{t}{3{,}6h}}\right)$$

$$= \underline{1{,}5m - 0{,}6m\left(1 - e^{-\frac{t}{3{,}6h}}\right)}$$

$$H(t=\infty) = 1{,}5m - 0{,}6m = \underline{\underline{0{,}9m}}$$

f)

$$G_2^* = \frac{H}{W_{be}} = \frac{G_2}{1 + G_2 \cdot G_{TA} \cdot G_c \cdot G_{BE}} = \frac{\frac{0{,}06}{3{,}6s+1}}{1 + \frac{0{,}06}{3{,}6s+1} \cdot 50 \cdot 1 \cdot 1} =$$

$$= \frac{0{,}06}{3{,}6s + 1 + \underbrace{0{,}06 \cdot 50}_{3}} = \frac{0{,}06}{3{,}6s + 4} = \frac{0{,}015}{0{,}9s + 1}$$

$$H(t) = \bar{H} + \hat{H}(t) = 1{,}5m \underbrace{- 10\,m^3/h \cdot 0{,}015\,m/(m^3/h)}_{0{,}15m}\left(1 - e^{-\frac{t}{0{,}9h}}\right)$$

$$H(t=\infty) = 1{,}5m - 0{,}15m = \underline{\underline{1{,}35m}}$$

g) $H(t=\infty) = \lim_{s \to 0}\left(s\, G_2^* \cdot Z\right)$ $\longrightarrow$ $0{,}025m = \lim_{s \to 0}\left(s \frac{\frac{0{,}06}{3{,}6s+1}}{1 + \frac{0{,}06}{3{,}6s+1} \cdot 10 \cdot A_{pc} \cdot 1} \cdot \frac{-10}{s}\right)$

$$0{,}025 = \frac{0{,}06\,(-10)}{1 + 0{,}06 \cdot 50 \cdot A_{pc}} \Rightarrow A_{pc} = (-)\,8{,}33$$