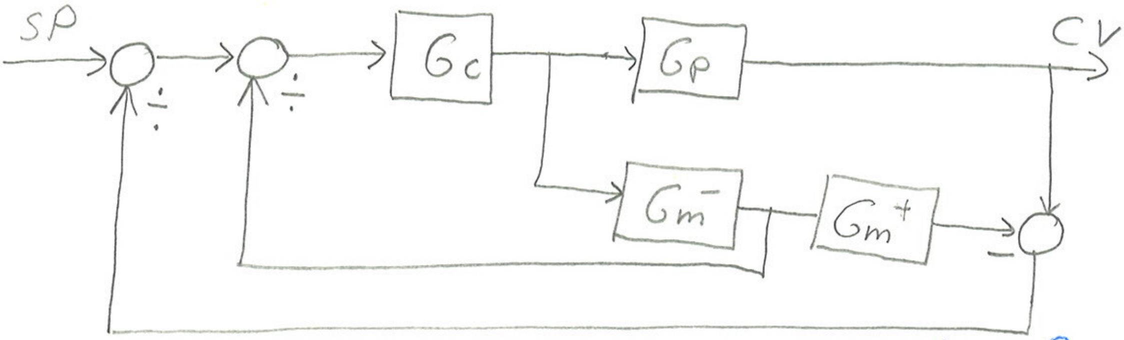
Smith prediktor

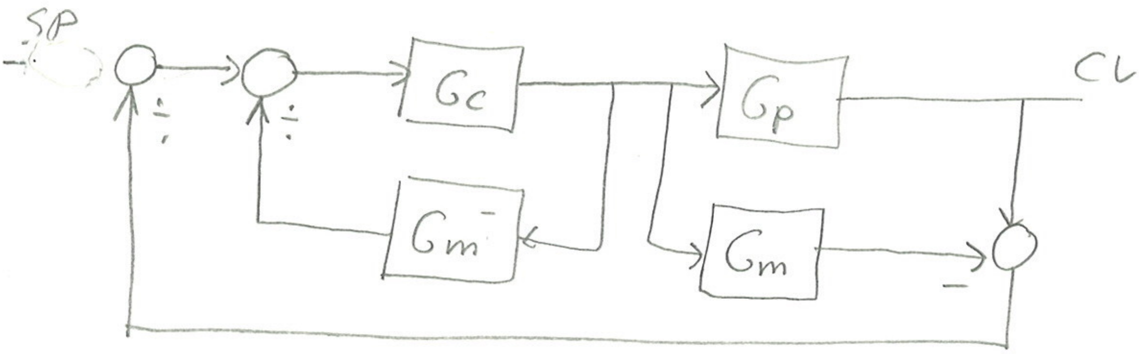
s. 621 1



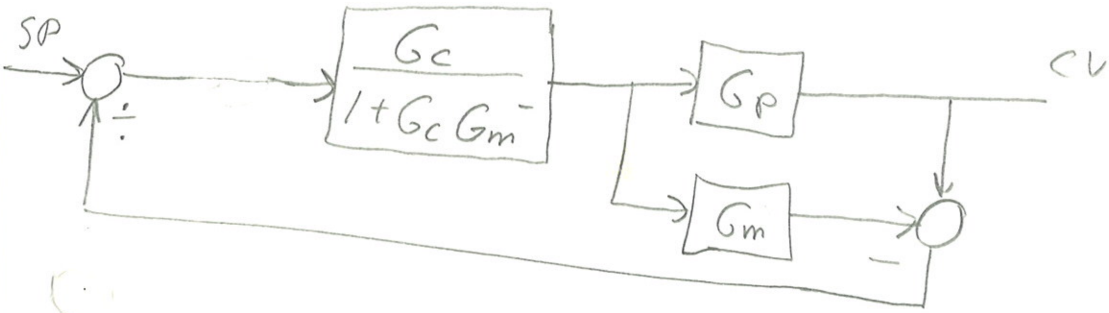
1

G_m^+, G_m^- } s. 611

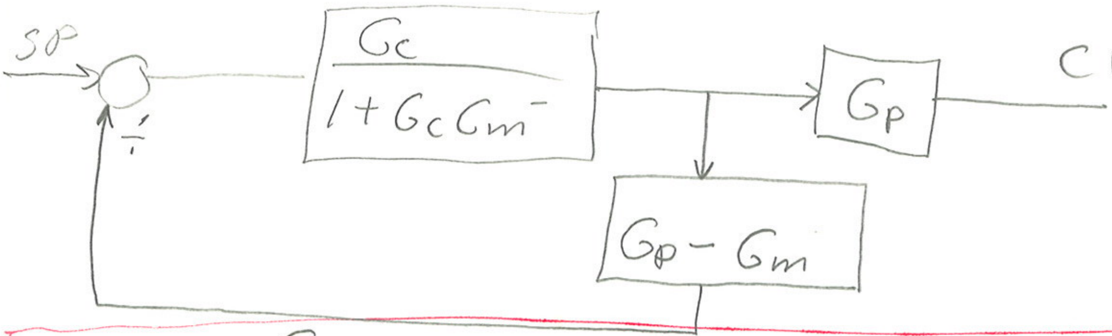
Transfer function from, r, to, y.



2



3



4

$$\frac{CV}{SP} = \frac{\dfrac{G_c}{1+G_c G_m^-}}{1+\dfrac{G_c}{1+G_c G_m^-}(G_p - G_m)} G_p = \frac{G_c G_p}{1+G_c G_m^- + G_c(G_p - G_m)}$$

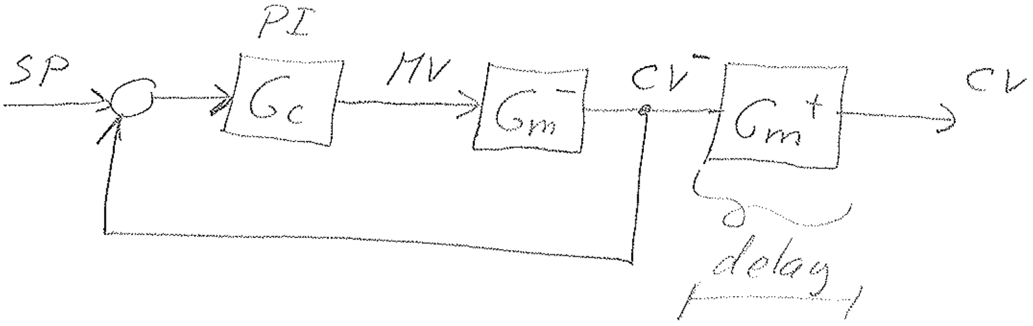
Perfekt modell Smith

$$G_p = G_m$$

$$G_p = G_m^- \cdot G_m^+$$

Har

$$\frac{CV}{SP} = \frac{G_c \cdot G_p}{1 + G_c \cdot G_m^-}$$



Bevis av 19.29
mult. teller og nevner med s og s→0

$$\frac{\frac{k_p k_c}{\cancel{T_i}}}{\frac{\cancel{k_c} k_m^-}{\cancel{T_i}} + \frac{(k_p - k_m) k_c}{\cancel{T_i}}} = \frac{k_p}{k_m^- - k_m + k_p} = 1$$

$$\Longleftrightarrow \boxed{k_m^- = k_m}$$

$$\lim_{t\to\infty} y(t) =$$

$$\lim_{s\to 0} \frac{\left(1 + k_p \frac{1+T_i s}{T_i s}\left(\frac{1}{s} - \frac{1}{s}e^{-\tau s}\right)\right)\frac{1}{s}e^{-\tau s}}{1 + \frac{1}{s} k_p \frac{1+T_i s}{T_i s}} \cdot \cancel{\frac{\Delta V}{s}} \cdot \cancel{s}$$

$$= \frac{1 + k_p \frac{1+T_i s}{T_i s}\left(\frac{1}{s} - \frac{1}{s}e^{-\tau s}\right) e^{-\tau s} \quad \cdot T_i s}{s + k_p \frac{1+T_i s}{T_i s} \quad \cdot T_i s} \Delta V$$

$$= \frac{T_i s + k_p(1+T_i s)\frac{1}{s}\overbrace{(1 - e^{-\tau s})}^{(1-(1-\tau s+\dots))}e^{-\tau s}\Delta V}{T_i s^2 + k_p(1+T_i s)}$$

• rekkeutvikling av $e^{-\tau s}$

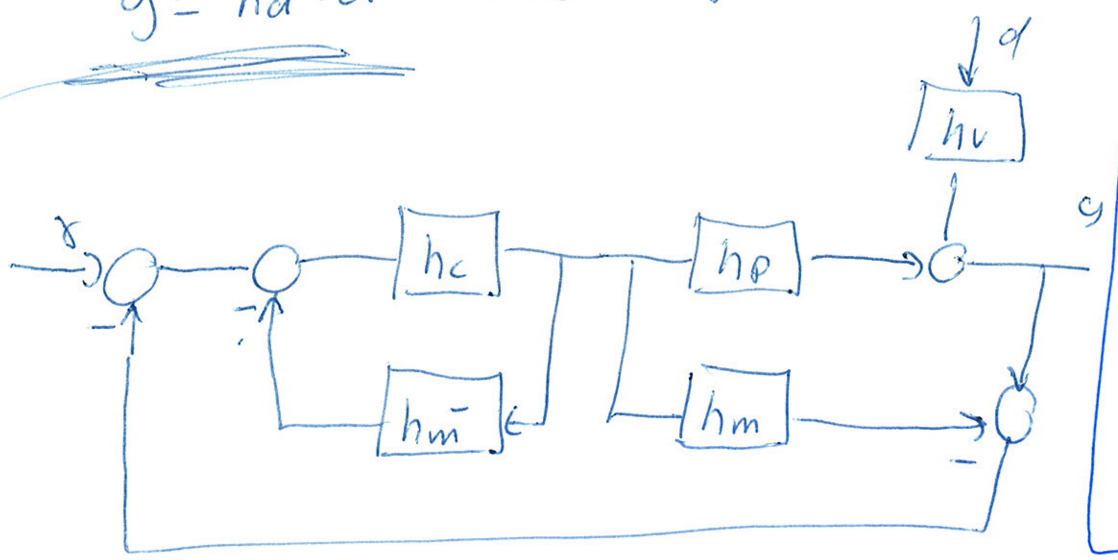
$$= \frac{T_i s + k_p(1+T_i s)(\tau + \dots)\Delta V}{T_i s^2 + k_p(1+T_i s)} \overset{s=0}{=} \underline{\underline{\tau \cdot \Delta V}}$$

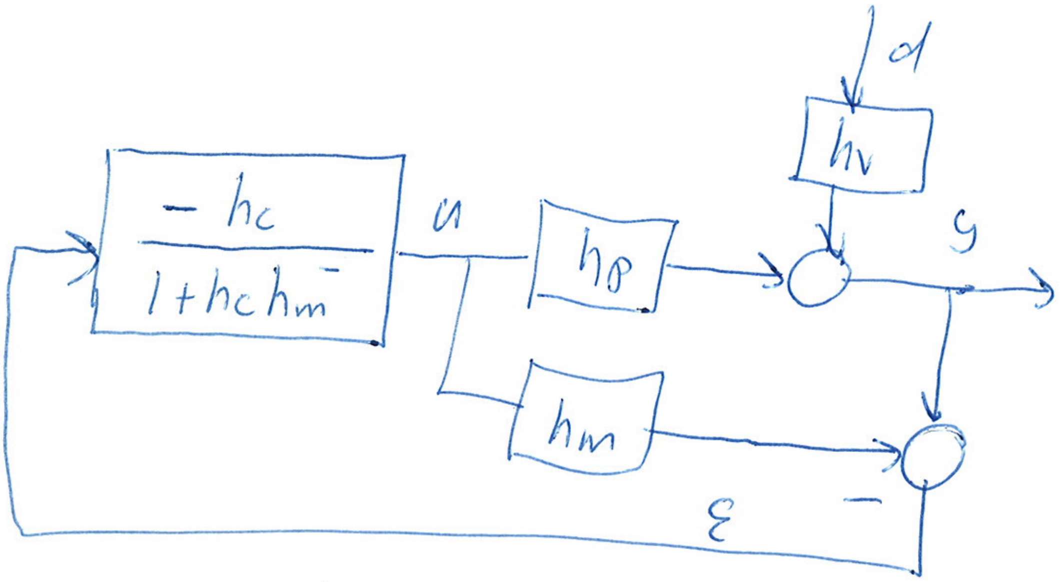
Har antatt: $h_p = \frac{1}{s}e^{-\tau s}$ og $h_p = h_m = h_v$

Dette betyr at vi får stasjonært avvik med integrator og transport forsinkelse.

$y = h_d \cdot d$ and $r = 0$

Transfer function from $d(\omega)$ to y.





$$\varepsilon = h_p u + h_v d - h_m u = (h_p - h_m) u + h_v d$$

$$y = h_v d + h_p u$$

$$u = -\frac{h_c}{1 + h_c h_m^-}\left((h_p - h_m) u + h_v d\right)$$

$$\left(1 + \frac{h_c}{1 + h_c h_m^-}(h_p - h_m)\right) u = -\frac{h_c h_v}{1 + h_c h_m^-} \cdot d$$

$$\left(1 + h_c h_m^- + h_c (h_p - h_m)\right) u = -h_c h_v \cdot d$$

$$u = -\frac{h_c h_v}{1 + h_c \bar{h}_m + h_c (h_p - h_m)} \cdot d$$

$$y = h_v d - \frac{h_c h_p h_v}{1 + h_c \bar{h}_m + h_c (h_p - h_m)} \cdot d$$

$$= \frac{1 + h_c \bar{h}_m + h_c (h_p - h_m) - h_c h_p}{1 + h_c \bar{h}_m + h_c (h_p - h_m)} h_v \cdot d$$

$$= \frac{1 + h_c \bar{h}_m - h_c h_m}{1 + h_c \bar{h}_m + h_c (h_p - h_m)} = \underline{\underline{\frac{1 + h_c (\bar{h}_m - h_m)}{1 + h_c \bar{h}_m + h_c (h_p - h_m)}}}$$

Smith predictor, disturbance

$$y = h_p u + h_w d \qquad (1)$$

$$dy = y - h_m u \qquad (2)$$

$$u = -\frac{h_c}{1 + h_c h_m^{-}} \cdot dy \qquad (3)$$

(2) → (3) give

$$u = -\frac{h_c}{1 + h_c h_m^{-}} (y - h_m u)$$

$$\left(1 - \frac{h_c h_m}{1 + h_c h_m^{-}}\right) u = -\frac{h_c}{1 + h_c h_m^{-}} y$$

$$(1 + h_c h_m^{-} - h_c h_m)\, u = -h_c y$$

$$u = -\frac{h_c}{1 + h_c h_m^{-} - h_c h_m} y \qquad (4)$$

(4) → (1) gives

$$y = -\frac{h_c h_p}{1 + h_c h_m^{-} - h_c h_m} y + h_w d \qquad (5)$$

From (5) we get

$$\left(1 + \frac{h_c h_p}{1 + h_c h_m^{-} - h_c h_m}\right) y = h_{ce}\, d$$

$$\Downarrow$$

$$\frac{1 + h_c h_m^{-} - h_c h_m + h_c h_p}{1 + h_c (h_m^{-} - h_m)}\, y = h_{ce}\, d$$

$$\Downarrow$$

$$\cancel{y = ((1-}$$

$$y = \frac{(1 + h_c (h_m^{-} - h_m))\, h_{ce}}{1 + h_c h_m^{-} + (h_p - h_m)\, h_c} \cdot d$$

QED