2020.09.11 Auto - Course 6

vendredi 11 septembre 2020 10:39

$$PID = k\left(1 + \frac{1}{T_i p} + T_d p\right) = k\left(\frac{1 + T_i p + T_i T_d p^2}{T_i p}\right)$$

$$\Delta = T_i^2 - 4 T_i T_d = T_i (T_i - 4 T_d)$$

First case: $T_i > 4 T_d$

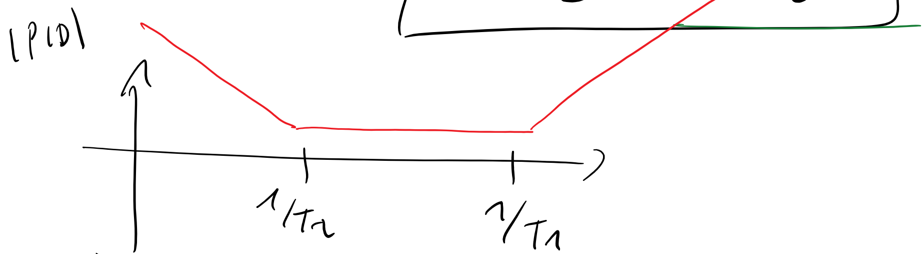
$\rightarrow$ 2 zeros real

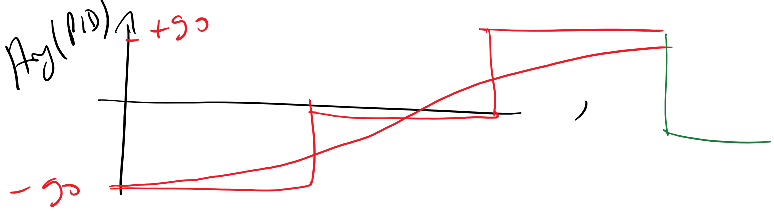
$$PID(p) = \frac{k}{T_i p}\left(1 + T_i p + T_i T_d p^2\right) = \frac{k}{T_i p}\left(1 + T_1 p\right)\left(1 + T_2 p\right)$$

$$\boxed{T_i = T_1 + T_2}$$

$$T_i T_d = T_1 T_2 \rightarrow T_d = \frac{T_1 T_2}{T_i} = \frac{T_1 T_2}{T_1 + T_2}$$

$$\boxed{T_d^{-1} = T_1^{-1} + T_2^{-1}}$$



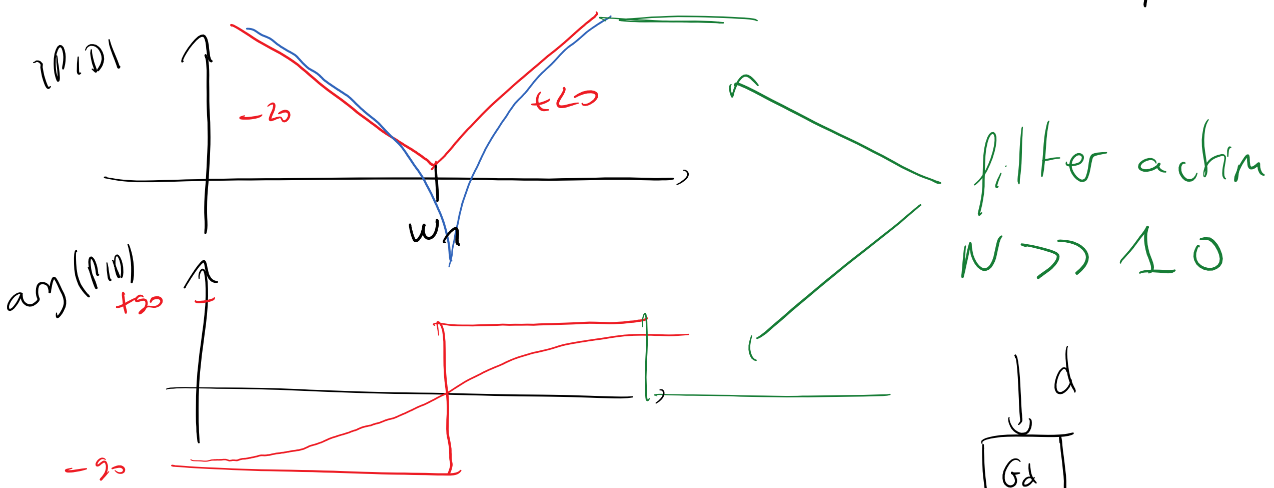


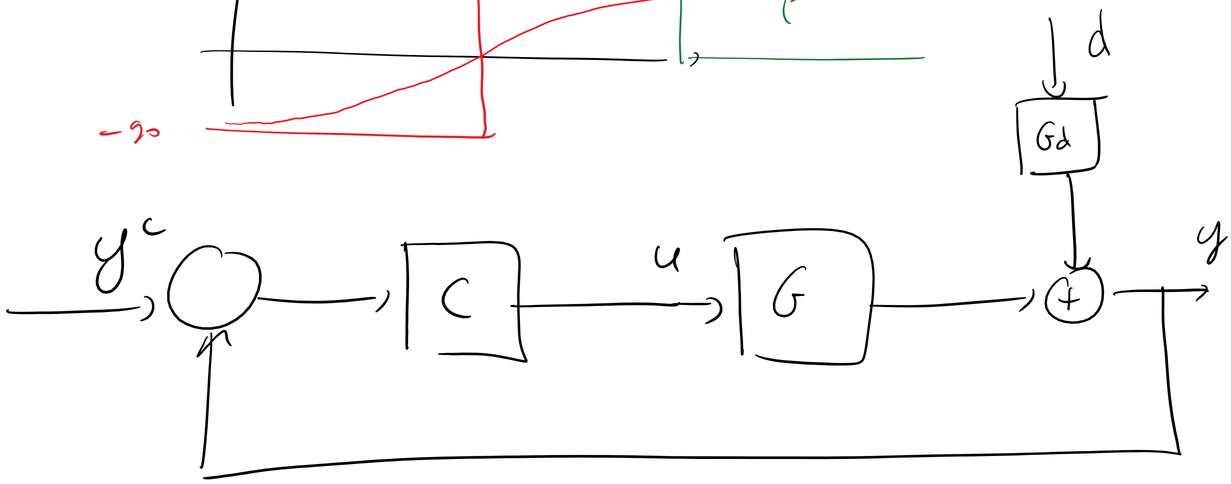
2nd Case: $T_i < 4 T_d$ $\rightarrow$ 2 zeros complex conjugate.

$$\frac{k}{T_i p}\left(1 + T_i p + T_i T_d p^2\right) = \frac{k}{T_i p}\left(1 + \frac{2\zeta}{\omega_n} p + \frac{p^2}{\omega_n^2}\right)$$

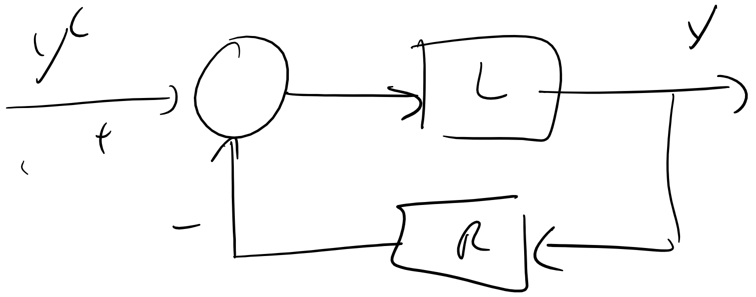
$$T_i = \frac{2\zeta}{\omega_n} \qquad T_i T_d = \frac{1}{\omega_n^2} \rightarrow T_d = \frac{1}{T_i \omega_n^2} = \frac{\omega_n}{2\zeta\omega_n^2} = \frac{1}{2\zeta\omega_n}$$

$\omega_n \qquad \omega_n^2 \qquad 2\zeta\omega_n \quad 2\zeta\omega_n$





$$y = G u + G_d d$$
$$= G\left(\tilde{u} - G^{-1} G_d d\right) + G_d d$$



$$\frac{Y}{y^c} = \frac{L}{1+RL} = \frac{L/R}{\frac{1}{R}+L}$$

if $|L| \gg |1/R| \Rightarrow \frac{Y}{y^c} \simeq \frac{L/R}{L} = 1/R$

if $|L| \ll |1/R| \Rightarrow \frac{Y}{y^c} \simeq \frac{L/R}{1/R} = L$