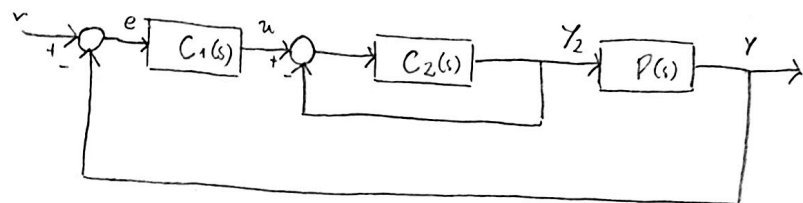
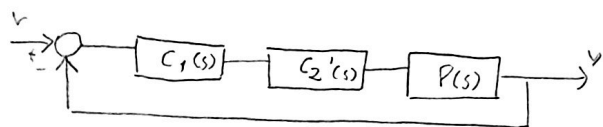


01)

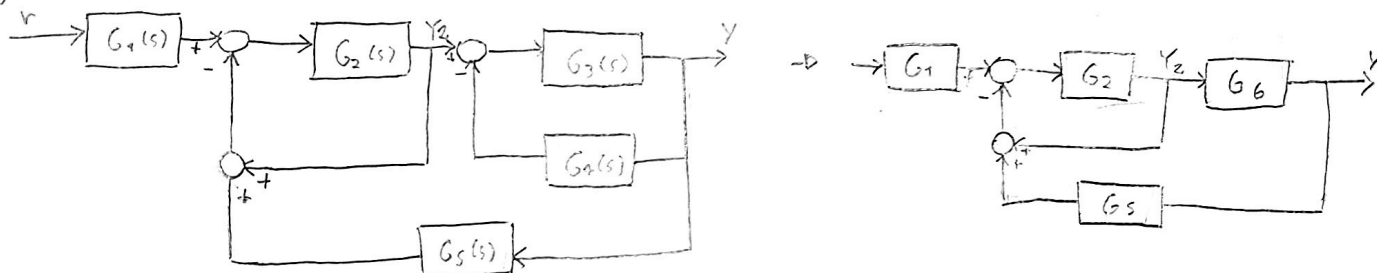


$$\hookrightarrow Y_2(s) = C_2 (U(s) - Y_2(s)) \rightarrow \frac{Y_2(s)}{U(s)} = C_2'(s) = \frac{C_2(s)}{1 + C_2(s)}$$



$$\hookrightarrow Y(s) = P(s) C_2'(s) C_1(s) (R(s) - Y(s)) \rightarrow \frac{Y(s)}{R(s)} = \frac{P(s) C_2'(s) C_1(s)}{1 + P(s) C_2'(s) C_1(s)} = \frac{P(s) C_2(s) C_1(s)}{1 + C_2(s) + P(s) C_2(s) C_1(s)}$$

02)

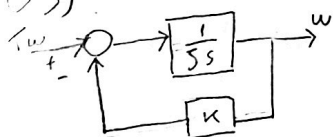


$$\hookrightarrow \frac{Y(s)}{Y_2(s)} = \frac{G_3(s)}{1 + G_3(s) G_4(s)} = G_6(s)$$

$$\hookrightarrow Y(s) = G_6(s) G_2(s) (G_1(s) R(s) - \frac{Y(s)}{G_6(s)} - Y(s) G_5) \rightarrow \frac{Y(s)}{R(s)} = \frac{G_1(s) G_2(s) G_6(s)}{1 + G_1(s) G_2(s) + G_1(s) G_2(s) G_5(s)}$$

$$\hookrightarrow \frac{Y(s)}{R(s)} = \frac{G_1(s) G_2(s) G_3(s)}{1 + G_1(s) G_2(s) + G_3(s) G_4(s) + G_1(s) G_2(s) G_3(s) G_4(s) + G_1(s) G_2(s) G_3(s)}$$

03)



$$\hookrightarrow U(s) = \frac{1}{s} (T_w(s) - k U(s)) \rightarrow \frac{U(s)}{T_w(s)} = \frac{1}{s + k} = H(s)$$

$$\hookrightarrow u(s) H(s) = \frac{1}{s} \frac{1}{s + k} = \frac{1}{ks} - \frac{1}{k(s + k)} = \frac{1}{k} \frac{1}{s} - \frac{1}{k} \frac{1}{s + \frac{k}{s}}$$

$$\hookrightarrow \mathcal{L}^{-1}\{u(s) H(s)\} = \frac{1}{k} u(t) - \frac{1}{k} e^{-\frac{kt}{s}} u(t) \leq 0,01 \rightarrow 0,01k > 1 - e^{-\frac{kt}{s}} \rightarrow k > 100$$