

Bismillah

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Matkul: Sistem Kendali Digital

1. Jika $\exp(x) = e^x$ dan diketahui $\exp\left(\frac{-K_z Z_1}{\sqrt{1-Z_1^2}}\right) = 5\%$, Hitung Z_1 !

Jawaban:

$$e^x = 5\%$$

$$\ln(e^x) = \ln\left(\frac{5}{100}\right)$$

$$x = -2,995$$

$$x = \frac{-K_z Z_1}{\sqrt{1-Z_1^2}}$$

$$-2,995^2 = \left(\frac{-3,14 Z_1}{1-Z_1}\right)^2$$

$$8,97 = \frac{9,8596 Z_1^2}{1-Z_1}$$

$$8,97 = 8,97 Z_1^2 = 9,8596 Z_1^2$$

$$8,97 = 18,8296 Z_1^2$$

$$Z_1^2 = \frac{8,97}{18,8296}$$

$$= 0,476$$

$$Z_1 = 0,69$$

2. Diketahui $\frac{N(s)}{s^2+4s+5} = \frac{K_p(s+K_i)}{s(s+1)}$

Hitunglah K_p dan K_i !

Jawaban:

$$\frac{N(s)}{s^2+4s+5} = \frac{K_p(s+K_i)}{\frac{s(s+1)}{1 + \frac{K_p(s+K_i)}{s(s+1)}}} = \frac{K_p \cdot s + K_p \cdot K_i}{\frac{s^2+s + K_p \cdot s + K_p K_i}{s^2+s}}$$

$$4s = s + K_p \cdot s$$

$$4 = \frac{s + K_p \cdot s}{s}$$

$$4 = 1 + K_p$$

$$K_p = 4 - 1 = 3$$

$$5 = K_p \cdot K_i$$

$$5 = 3 \cdot K_i$$

$$K_i = \frac{5}{3} \approx 1,6$$

3. Diketahui: $\frac{N(s)}{s^2 + 2\zeta\omega_n s + \omega_n^2} = \frac{2}{(s+1)(s+3)}$ Hitunglah $N(s)$, ζ dan ω_n

Jawaban:

$$\frac{N(s)}{s^2 + 2\zeta\omega_n s + \omega_n^2} = \frac{2}{(s+1)(s+3)} = \frac{2}{1 + \frac{2}{(s+1)(s+3)}} = \frac{2}{s^2 + 4s + 3} = \frac{2}{s^2 + 4s + 5}$$

• $N(s) = 2$

• $\omega_n^2 = 5$

$\omega_n = \sqrt{5}$

• $2\zeta\omega_n = 4$

$\zeta = \frac{4}{2\sqrt{5}} = \frac{2}{\sqrt{5}}$

4. Diketahui $\mathcal{L}\{f(t) = \cos \omega t\} = f(s) = \frac{s}{s^2 + \omega^2}$ dan $\mathcal{L}\{e^{-at} f(t)\} = F(s+a)$. Hitunglah $\mathcal{L}\{e^{-t} \cos \omega t\}$!

Jawaban:

$\mathcal{L}\{e^{-at} \cos \omega t\} = \frac{s+a}{(s+a)^2 + \omega^2}$

$\mathcal{L}\{e^{-t} \cos \omega t\} = \frac{s+1}{(s+1)^2 + \omega^2}$

5. Diketahui $\frac{3}{2s^2 + 12s + 10} = \frac{A}{(s+a)} + \frac{B}{(s+b)}$. Hitunglah a , b , A dan B !

Jawab:

$$\frac{3}{2s^2 + 12s + 10} = \frac{As + Ab + Bs + Ba}{s^2 + sa + sb + ab}$$

$$\frac{3}{(2s+10)(s+1)}$$

maka: $b = 1$

$a = s+10$

$As + Ab + Bs + Ba = 3$

$As + A + Bs + B + 10B = 3$

$2B + 10B = 3$

$B = \frac{1}{4}$

$A = 2B = \frac{1}{2}$

$As + Bs + Bs = 0$

$As = 2Bs$

$A = 2B$

$b = 1$

$a = s+10$