OTOMATİK KONTROL - 2
VİZE SINAVI YANITLARI Bahar 2021-2022

1.)

$$G(s) = \frac{\frac{K_1 . K_2 . \frac{150s}{s^2+12s+40}}{1 + \frac{K_1 . K_2 . 150s}{s^2+12s+40}}}{} \cdot K_3$$

$$G(s) = \frac{\frac{\frac{0,04}{s} \cdot \frac{150s}{s^2+12s+40}}{1 + \frac{0,04}{s} \cdot \frac{150s}{s^2+12s+40}}}{} \cdot \frac{10}{6}$$

$$G(s) = \frac{\frac{6}{s^2+12s+40}}{1 + \frac{6}{s^2+12s+40}} \cdot \frac{10}{6} \Rightarrow \frac{6}{s^2+12s+46} \cdot \frac{10}{6}$$

$$G(s) = \frac{10}{s^2+12s+46}$$

Bu fonksiyonu $G(s) = \frac{10}{46} \cdot \frac{46}{s^2+12s+46}$ olarak yazabiliriz. (1Sp)

Bu durumda;

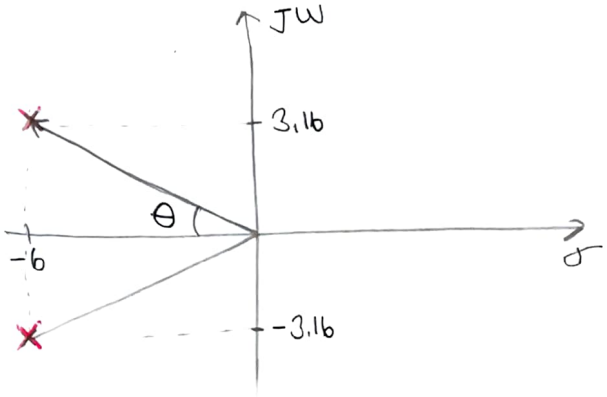
Doğal frekans = $\omega_n = \sqrt{46} = 6,78$ rad/s.

Sönüm oranı = $\zeta = \frac{12}{2 . 6,78} = 0,88$

$$s_{1,2} = -\xi.\omega_n \pm j\omega_n\sqrt{1-\xi^2}$$

$$s_{1,2} = \underbrace{-6}_{\sigma} \pm j\underbrace{3.16}_{\omega_d}$$

Sanal Düzlemde Kökleşin Yerleri:



$$\theta = \tan^{-1}\left(\frac{3,16}{6}\right)$$

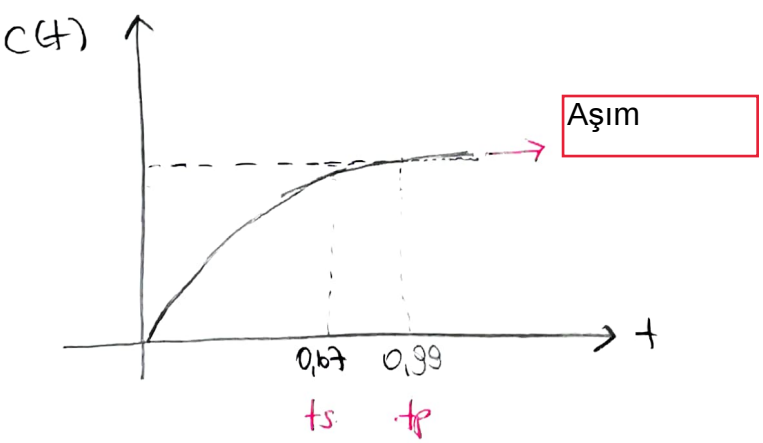
$$\theta = 0,48 \text{ rad}$$

$$M_p = e^{\frac{-\xi\pi}{\sqrt{1-\xi^2}}} = e^{\frac{-0,88.3,14}{\sqrt{1-0,88^2}}}$$ (7p)

$M_p = 0,003$ Aşım miktarı

$$t_p = \frac{\pi}{\omega_d} = \frac{3,14}{3,16} = 0,99_{sn}$$ (7p)

$$t_s = \frac{4}{\xi.\omega_n} = \frac{4}{0,88.6,78} = 0,67_{sn}$$ (7p)



(5p)

2.)

a) $H(s) = 1$ olduğu için sistem birim geri beslemelidir

İleri yol transfer fonksiyonu

$$G(s) = \frac{8}{s^2+2s+5}$$

$$e(\infty) = \lim_{s\to 0} s.E(s)$$

$$e(\infty) = \lim_{s\to 0} \frac{s.R(s)}{1+G(s)} = \frac{s.\left(\frac{1}{s}\right)}{1+\frac{8}{s^2+2s+5}}$$

$$e(\infty) = \lim_{s\to 0} \frac{s^2+2s+5}{s^2+2s+13} = \frac{5}{13} = 0{,}3846$$

(1Sp)

b) $H(s) = \frac{0.5}{0.1s+1}$ olduğu için sistemin birim geri beslemeli hale getirilmesi gerekir

Bu durumda ileri yol transfer fonksiyonu:

$$G_e(s) = \frac{G(s)}{1+G(s).H(s)-G(s)} = \frac{\frac{8}{s^2+2s+5}}{1+\frac{8}{s^2+2s+5}\cdot\frac{0{,}5}{0{,}1s+1}-\frac{8}{s^2+2s+5}}$$

$$G_e(s) = \frac{8.(0{,}1s+1)}{0{,}1s^3+0{,}2s^2+0{,}5s+s^2+2s+5+4-0{,}8s-8}$$

$$G_e(s) = \frac{8+0{,}8s}{0{,}1s^3+1{,}2s^2+1{,}7s+1}$$

2. sorunun devamı...

Sistem tip 0 'dır.

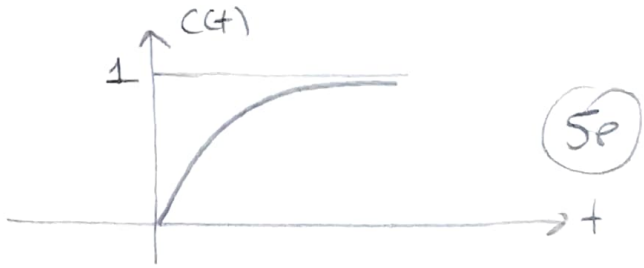
$$K_p = \lim_{s \to 0} \frac{0,8s + 8}{0,1s^3 + 1,2s^2 + 1,7s + 1} = 8$$

$$e(\infty) = \frac{1}{1 + K_p} = \frac{1}{1+8} = \frac{1}{9} = 0,111$$

(25e)

3)

a) $G(s) = \frac{1}{(s+2).(s+1)}$

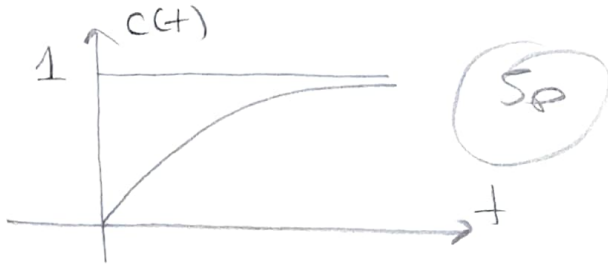


kökler $s_1 = -2$, $s_2 = -1$

iki gerçek kök

sistem kararlı ve aşırı sönümlüdür

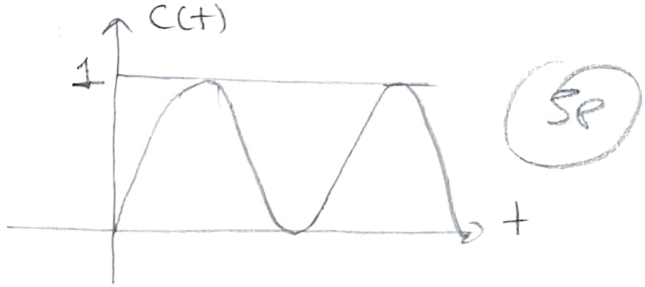
b) $G(s) = \frac{1}{(s+1)^2}$



$s = -1$ 'de katlı kök

kararlı, kritik sönümlüdür

c) $G(s) = \frac{3}{s^2 + 9}$



$s_1 = j3$, $s_2 = -j3$

kökler sanal eksende

sistem marjinal

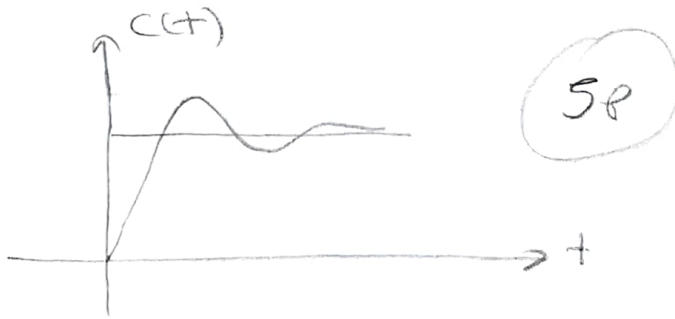
kararlıdır

d) Kökler

$s_1 = -2 + j3$, $s_2 = -2 - j3$

eşlenik kökler,

sistem kararlı, az sönümlü



Kökler,
Kararlılık
Tip
Grafik.