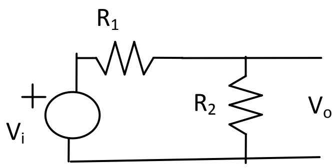
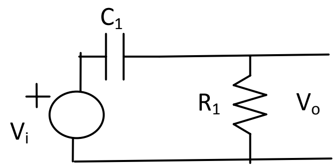
511)grafiklerini cizin.

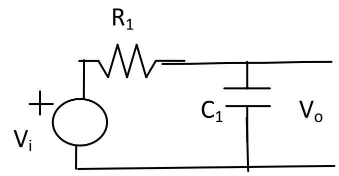
a)u(t) (birim basamak) b) δ(t) (impuls)

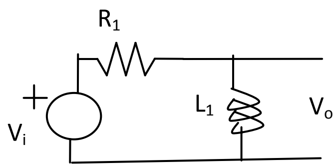
Bu fonksiyonlarin kullanimi ile ilgili olarak elektrik muhendisliginde ve makina muhendisliginde ornekler verin.

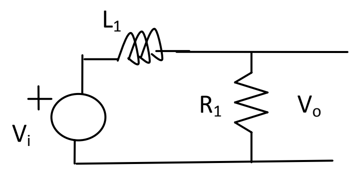
512)Asagidaki devrelerin transfer fonksiyonlarini bulun.

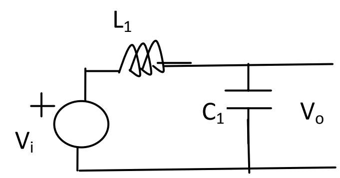


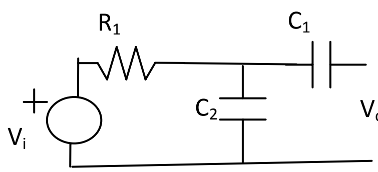


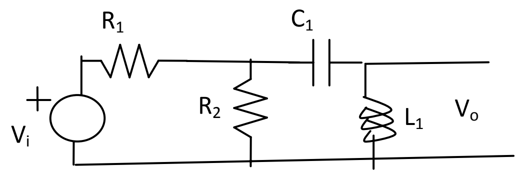


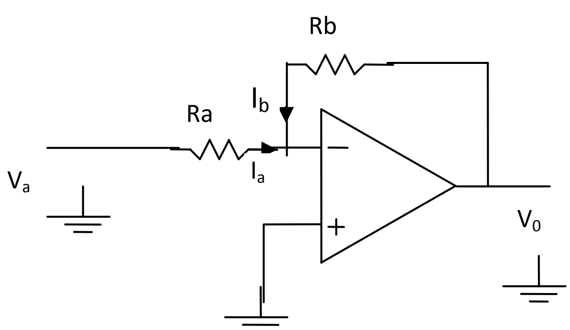


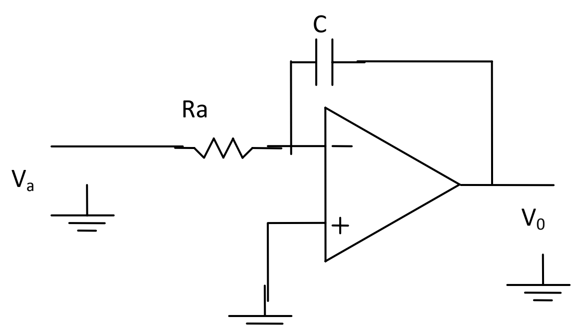




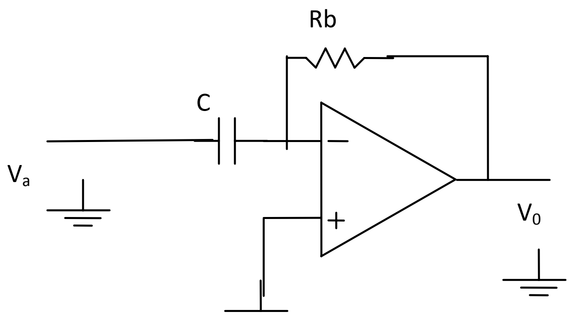


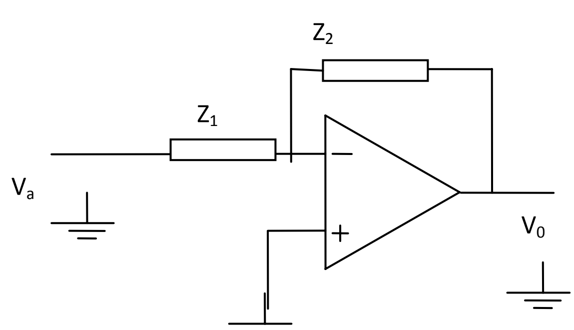




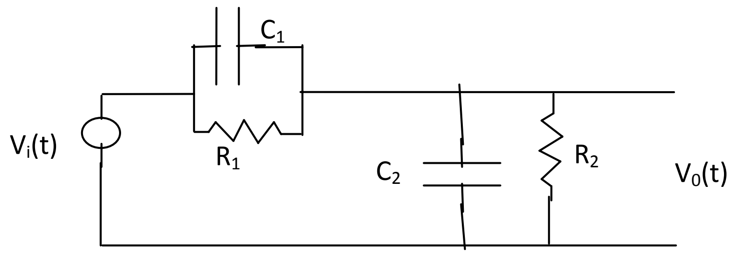


Not Ia=Ib (ideal opam akim cekmez) Ia=Va/Ra, Ib=-Vo/Rb, → Vo/Va=-Rb/Ra





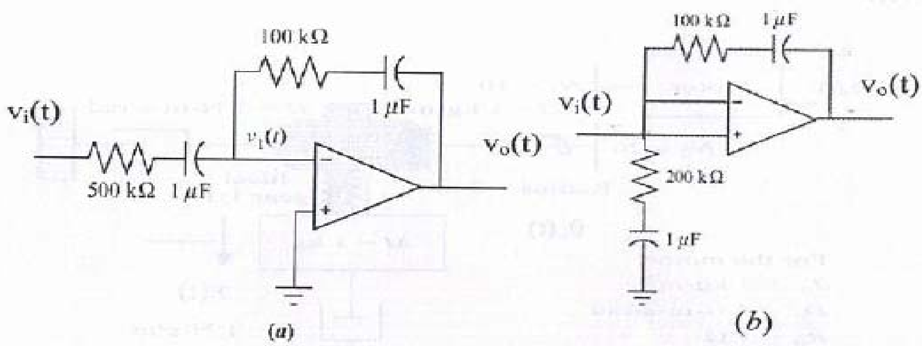
1) 562) Find the transfer function $\frac{V_0(s)}{V_i(s)}$ of the following circuit.



563)

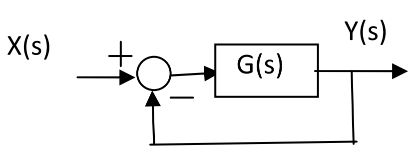
Alıştırma

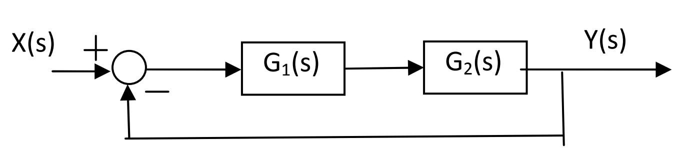
1. Şekil 2.34'te verilen işlemsel kuvvetlendiricili kontrol elemanlarının her ikisinin de $G_c(s) = V_o(s)/V_i(s)$ toplam transfer fonksiyonunu bulunuz.



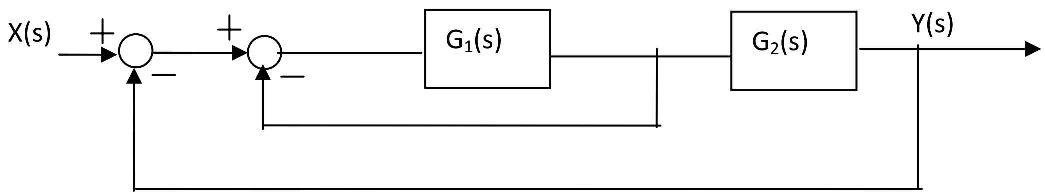
517)Asagidaki devrelerde toplam transfer fonksiyonlarini bulun.

7) $G_1(s)=\frac{1}{s+1}$, $G_2(s)=\frac{s+2}{s+3}$



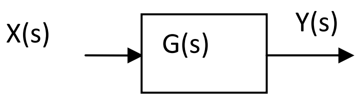


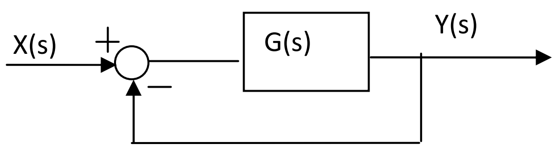
4) $\frac{Y(s)}{X(s)}$ oranini bulun.

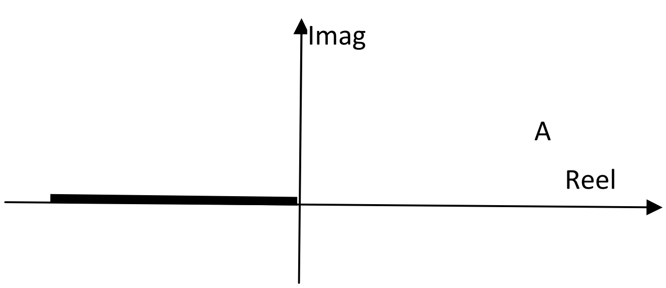


6) Using the approximation $\frac{dx}{dt} = \frac{x(t+T)-x(t)}{T}$. calculate x(0.1), x(0.2),x(0.3) for the following differential equation. $\frac{dx}{dt} = 2x^2 + \delta(t)$. x(0)=0, Assume T=0.1.

7) Find Steady state error e_{ss} for the following systems. $G(s)=\frac{s+1}{s+2}$, x(t)=u(t).







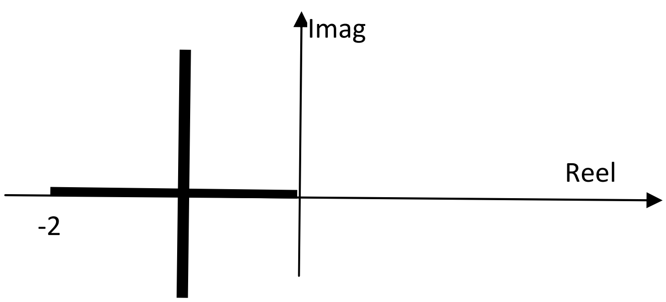
Y=KG(X-Y)
Y+KGY=KGx
Y/X=KG/(1+KG)

$$\frac{Y(s)}{X(s)}=\frac{KG(s)}{1+KG(s)}=\frac{K\frac{1}{s+1}}{1+K\frac{1}{s+1}}=\frac{K}{s+1+K}$$

paydanin koklerinin geometrik yeri

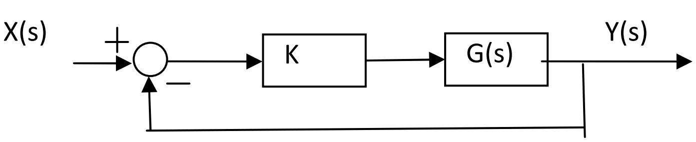
121)
$s^2+2s=0$ koku nedir → $s_1=-2$, $s_2=0$
$s^2+2s+0.1=0$ koku nedir → $s_1=-1.94$, $s_2=-0.05$
$s^2+2s+0.5=0$ koku nedir → $s_1=-1.70$, $s_2=-0.29$
$s^2+2s+0.9=0$ koku nedir → $s_1=-1.31$, $s_2=-0.68$

$s^2+2s+1.1=0$ koku nedir → $s_1=-1-0.31j$, $s_2=-1+0.31j$
$s^2+2s+1.5=0$ koku nedir → $s_1=-1-0.707j$, $s_2=-1+0.707j$
$s^2+2s+2=0$ koku nedir → $s_1=-1-1j$, $s_2=-1+1j$
$s^2+2s+5=0$ koku nedir → $s_1=-1-2j$, $s_2=-1+2j$
$s^2+2s+10=0$ koku nedir → $s_1=-1-3j$, $s_2=-1+3j$
$s^2+2s+100=0$ koku nedir → $s_1=-1-9.95j$, $s_2=-1+9.95j$
$s^2+2s+10000=0$ koku nedir → $s_1=-1-99.9j$, $s_2=-1+99.9j$



$s^2+2s+K=0$ denkleminin koklerinin geometrik yeri

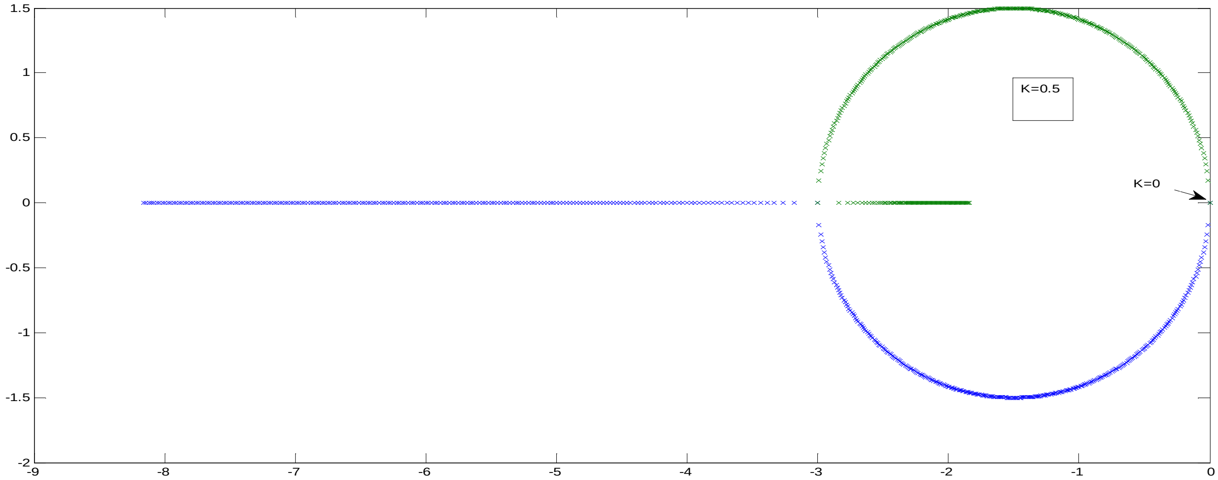
131) G(s)= $\frac{1}{s^2+2s+0.1}$

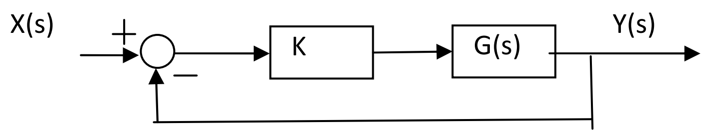


$$\frac{Y(s)}{X(s)}=\frac{KG(s)}{1+KG(s)}=\frac{K\frac{1}{s^2+2s+0.1}}{1+K\frac{1}{s^2+2s+0.1}}=\frac{K}{s^2+2s+0.1+K}$$

--- -

141)
$s^2+K(2s+3)=0$ denkleminin koklerinin geometrik yeri



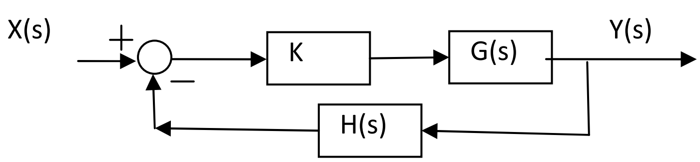


G(s)= $\dfrac{2s+3}{s^2}$

$$\frac{Y(s)}{X(s)} = \frac{KG(s)}{1+KG(s)} = \frac{K\dfrac{2s+3}{s^2}}{1+K\dfrac{2s+3}{s^2}} = \frac{K(2s+3)}{s^2+K(2s+3)}$$

---

141)



G(s)= $\dfrac{2s+3}{s^2}$, H(s)= $\dfrac{s}{s+1}$, jjjj

Y=KG(X-HY)
Y+KGHY=KGx
Y/X=KG/(1+KGH)

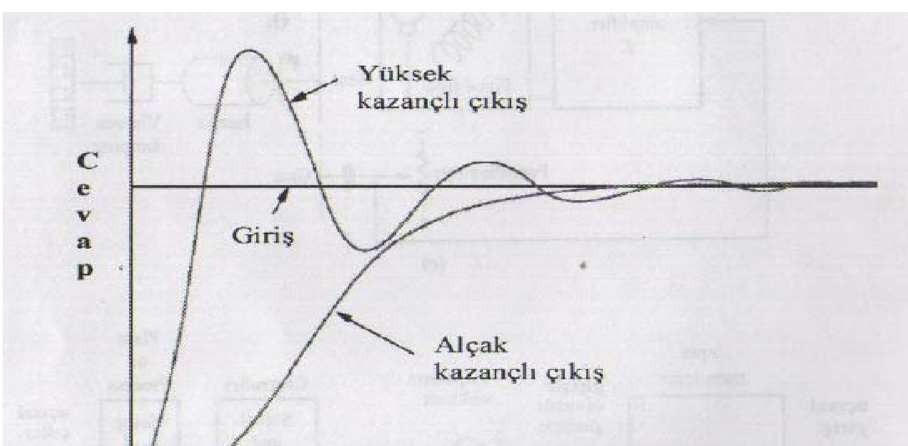
$$\frac{Y(s)}{X(s)} = \frac{KG(s)}{1+KG(s)} = \frac{K\dfrac{2s+3}{s^2}}{1+K\dfrac{2s+3}{s^2}\dfrac{s}{s+1}} = \frac{K(2s+3)(s+1)}{s^2(s+1)+K(2s+3)s}$$

8)Fiziksel sistemlerin cogu dogal olarak kararlidir.

9)Kapali cevrim devamli kararlidir.
10)kapali cevrimin avantajlari
a)
b)
c)
11)kapali cevrimin dezavantajlari
a)
b)
c)
12)Asim(overshoot) ne kadar buyuk ise o kadar iyi tasarlanmistir. hedef yuksek asim elde etmektir.
13)Yerlesme zamani .....
14)yukselme zamani
15)??? hatasi

1. Açık çevrimli sistemlerin yarar ve sakıncalarını sıralayınız.
2. Kapalı çevrimli sistemlerin yarar ve sakıncalarını sıralayınız.
3. aa ve da kontrol sistemlerini tanımlayınız.
4. Bir sayısal kontrol sisteminin sürekli verili kontrol sistemine üstünlüğünü belirtiniz.
5. Kapalı çevrimli kontrol sistemleri genellikle açık çevrimli sistemlerden daha doğrudur. (D) (Y)
6. Geribesleme bazen bir kontrol sisteminin duyarlığını düzeltmek için kullanılır. (D) (Y)
7. Eğer açık çevrimli sistem kararsız ise geribesleme uygulayarak kararlık her zaman artırılabilir. (D) (Y)
8. Geribesleme bir frekans bölgesinde sistem kazancını artırırken diğer bir bölgede azaltabilir. (D) (Y)
9. Doğrusal olmayan elemanlar bir kontrol sistemine bazen davranışı düzeltmek üzere yerleştirilir. (D) (Y)
10. İşaretlerin tabiatı nedeniyle ayrık verili kontrol sistemleri gürültüye karşı daha hassastır. (D) (Y)

351)Asagidaki sekli yorumlayiniz.



2-1. Aşağıdaki fonksiyonların kutup ve sıfırlarını (varsa sonsuzdakiler dahil olmak üzere) bulunuz. s - düzleminde sonlu kutupları X ve sonlu sıfırları O ile işaretleyiniz.

(a) $G(s)=\dfrac{10(s+2)}{s^2(s+1)(s+10)}$, (b) $G(s)=\dfrac{10s(s+1)}{(s+2)(s^2+3s+2)}$,

(c) $G(s)=\dfrac{10(s+2)}{s(s^2+2s+2)}$, (b) $G(s)=\dfrac{e^{-2s}}{10s(s+1)(s+2)}$.

2-2. Aşağıdaki fonksiyonların Laplace dönüşümlerini bulunuz. Uygulanabildiğinde Laplace dönüşümlerine ilişkin teoremleri kullanınız:

(a) $g(t)=5te^{-5t}u_s(t)$, (b) $g(t)=(t\sin 2t+e^{-2t})u_s(t)$,

(c) $g(t)=2e^{-2t}\sin 2t\, u_s(t)$, (d) $g(t)=\sin 2t\cos 2t\, u_s(t)$,

(e) $g(t)=\sum_{k=0}^{\infty} e^{-5kT}\delta(t-kT)$, $\delta(t)$ = birim impuls fonksiyonu.

2-5. Aşağıdaki diferansiyel denklemleri Laplace dönüşümü uygulayarak çözünüz:

(a) $\dfrac{d^2f(t)}{dt^2}+5\dfrac{df(t)}{dt}+4f(t)=e^{-2t}u_s(t)$ Başlangıç koşullarının sıfır olduğu varsayılacaktır.

(b) $\dfrac{dx_1(t)}{dt}=x_2(t)$

$\dfrac{dx_2(t)}{dt}=-2x_1(t)-3x_2(t)+u_s(t)$, $x_1(0)=1,\ x_2(0)=0.$

2-6. Aşağıdaki fonksiyonların ters Laplace dönüşümlerini bulunuz. İlkin $G(s)$'i kısmi kesirlere ayırınız, sonra Laplace dönüşüm tablosundan yararlanınız. Kısmi kesirlere ayırmada elinizin altındaki herhangi bir bilgisayar programı mevcut ise kullanınız:

(a) $G(s)=\dfrac{1}{s(s+2)(s+3)}$, (b) $G(s)=\dfrac{10}{(s+1)^2(s+3)}$,

(c) $G(s)=\dfrac{100(s+2)}{s(s^2+4)(s+1)}e^{-s}$. (d) $G(s)=\dfrac{2(s+1)}{s(s^2+s+2)}$,

(e) $G(s)=\dfrac{1}{(s+1)^3}$, (f) $G(s)=\dfrac{2(s^2+s+1)}{s(s+1.5)(s^2+5s+5)}$.

2-7. Aşağıdaki matrislerin toplam ve farklarını alınız. Çok kolay olduğundan bir bilgisayardan yararlanmayınız:

(a) $\begin{bmatrix}5 & -6\\0 & 3\end{bmatrix}+\begin{bmatrix}10 & -3\\2 & -3\end{bmatrix}$, (b) $\begin{bmatrix}2 & -2\\0 & 10\\3 & 0\end{bmatrix}-\begin{bmatrix}10 & 0\\3 & 4\\0 & -4\end{bmatrix}$,

(c) $\begin{bmatrix}\frac{1}{s+1} & 3 & \frac{1}{s}\\ \frac{2}{s} & 0 & \frac{1}{s+3}\end{bmatrix}+\begin{bmatrix}1 & 0 & -10\\ s & \frac{1}{s} & 1\end{bmatrix}$.

2-9. Aşağıdaki cebrik denklem takımlarını Ax = B biçiminde ifade ediniz.

(a)
$$x_1 + x_2 - x_3 = 1$$
$$-x_1 + 3x_2 - x_3 = 1$$
$$3x_1 - 5x_2 - 2x_3 = 0,$$

(b)
$$x_1 + x_2 - x_3 = 1$$
$$-x_1 + 3x_2 - x_3 = 1$$
$$2x_1 - 2x_2 \quad = 0.$$

Bu denklemlerin doğrusal bağımsız olup olmadığını görmek üzere **A** matrisinin tersini bulunuz. **A** matrisinin tersini bulmak için **MATLAB** ve benzeri bir bilgisayar programından yararlanınız. Denklemlerin doğrusal bağımsız olmaması halinde x_1, x_2 ve x_3 için bir çözüm verilebilir mi?

2-10. Aşağıdaki birinci mertebeden diferansiyel denklem takımını

$$\frac{d\mathbf{x}(t)}{dt} = \mathbf{A}\mathbf{x}(t) + \mathbf{B}\mathbf{u}(t)$$

vektör - matris biçiminde ifade ediniz.

$$\frac{dx_1(t)}{dt} = -x_1(t) + 2x_2(t)$$

$$\frac{dx_2(t)}{dt} = -2x_2(t) + 3x_3(t) + u_1(t)$$

$$\frac{dx_3(t)}{dt} = -x_1(t) + 3x_2(t) - x_3(t) + u_2(t).$$

2-11. Aşağıdaki matrislerin, eğer varsa, terslerini bulunuz. Problemleri önce elle ve sonra mevcut herhangi bir bilgasayar programıyla çözünüz:

(a) $\mathbf{A} = \begin{bmatrix} 2 & 5 \\ 10 & -1 \end{bmatrix}$, (b) $\mathbf{A} = \begin{bmatrix} 3 & 0 & -1 \\ -2 & 1 & 2 \\ 0 & 1 & -1 \end{bmatrix}$,

(c) $\mathbf{A} = \begin{bmatrix} 1 & 3 & 4 \\ -1 & 1 & 0 \\ -1 & 0 & -1 \end{bmatrix}$, (d) $\mathbf{A} = \begin{bmatrix} 0 & 1 & 0 \\ 2 & -2 & 3 \\ 0 & 1 & 5 \end{bmatrix}$.

2-12. Aşağıdaki matrislerin rankını bulunuz:

(a) $\begin{bmatrix} 3 & 2 \\ 6 & 1 \\ 3 & 0 \end{bmatrix}$, (b) $\begin{bmatrix} 2 & 4 & 0 & 8 \\ 1 & 2 & 6 & 3 \end{bmatrix}$.

(c) $\begin{bmatrix} 1 & 0 & 0 \\ 5 & 0 & 0 \end{bmatrix}$, (d) $\begin{bmatrix} 1 & 0 & 0 & 1 \\ 0 & 0 & 5 & 0 \end{bmatrix}$.

3-1. $r(t)$ giriş ve $y(t)$ çıkış olmak üzere aşağıdaki diferansiyel denklemler doğrusal zamanla değişmeyen sistemleri ifade etmektedir. Her sisteme ilişkin $Y(s)/R(s)$ transfer fonksiyonunu bulunuz.

(a) $$\frac{d^3y(t)}{dt^3}+2\frac{d^2y(t)}{dt^2}+5\frac{dy(t)}{dt}+6y(t)=3\frac{dr(t)}{dt}+r(t),$$

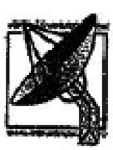
(b) $$\frac{d^4y(t)}{dt^4}+10\frac{d^2y(t)}{dt^2}+\frac{dy(t)}{dt}+5y(t)=5r(t),$$

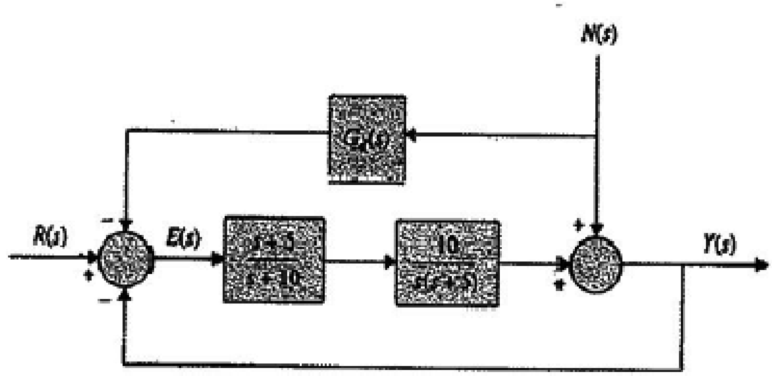
(c) $$\frac{d^3y(t)}{dt^3}+10\frac{d^2y(t)}{dt^2}+2\frac{dy(t)}{dt}+y(t)+2\int_0^t y(\tau)d\tau=\frac{dr(t)}{dt}+2r(t),$$

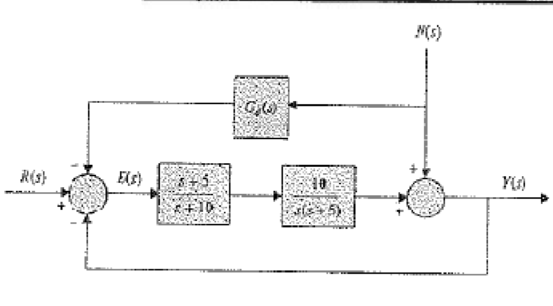
(d) $$2\frac{d^2y(t)}{dt^2}+\frac{dy(t)}{dt}+5y(t)=r(t)+2r(t-1).$$

3-17. Şekil 1-7'de görülen güneş kolektörüne ait anten kontrol sisteminin blok diyagramı Şekil 3P-17'de verilmiştir. $N(s)$ işareti anteni bozucu olarak etkileyen rüzgarı ifade etmektedir. $G_d(s)$ ileri besleme transfer fonksiyonu, $N(s)$'in $Y(s)$ çıkışına etkisini gidermek için kullanılır. $Y(s)/N(s)|_{R=0}$ transfer fonksiyonunu bulunuz. $N(s)$'yi tamamen gideren $G_d(s)$ ifadesini bulunuz.

▲ Anten kontrol sistemi







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5)Durum denklemleri formunda yazin.

Find the characteristic roots

$$\frac{dy}{dt} + y - 2u + aw = 0$$

$$\frac{dw}{dt} - by + 4u = 0$$

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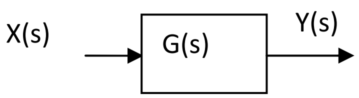
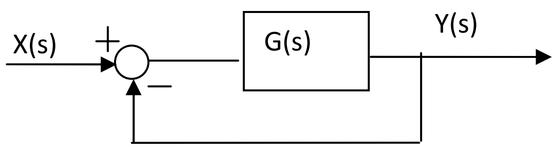
213) Surekli hal hatasi e_{ss} yi hesaplayin. $G(s) = \frac{s+1}{s+2}$, $x(t)=u(t)$.





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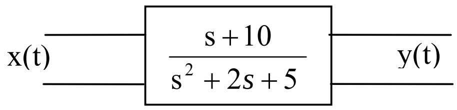
2) $Y(s)=\frac{1}{s^2}$, Calculate and draw y(t)

2) Calculate y(t) and draw y(t) for the following system. if x(t)= δ(t) . δ(t)) is impuls function.



3)State True or False

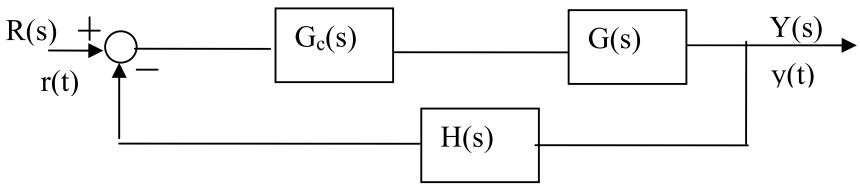
Disturbance signal in control systems is

------------- a)Desired signal

-------------- b) Unwanted input signals

-------------- c) Output signals

4)A general type control system diagram are shown below



Write the meaning of each term

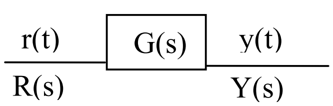
r(t) = y(t) =

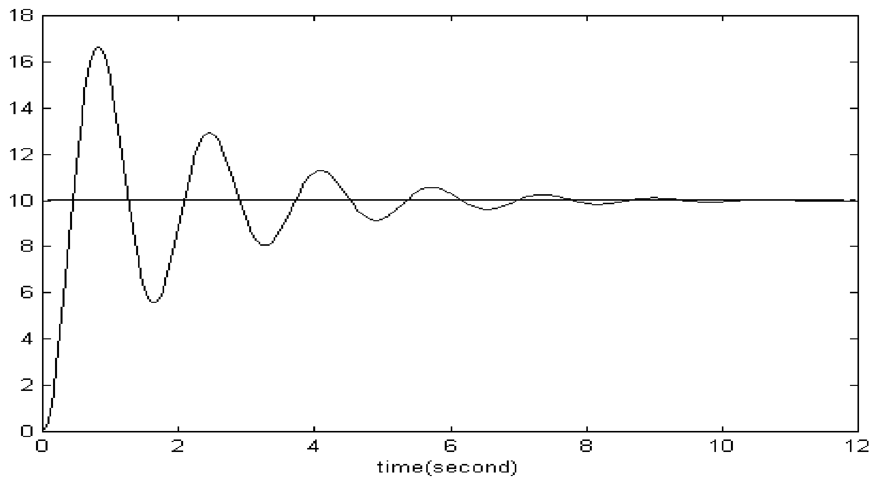
$G_c(t)$ = G(t) =

H(s) =

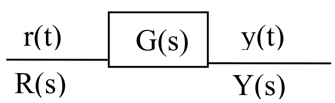
The main purpose of control system is ---

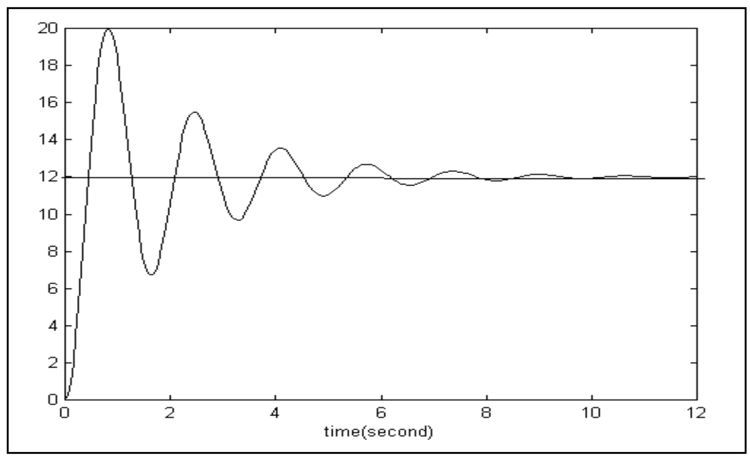
5)The input to the following system is r(t)=10 u(t) (u(t) is step function). The output are given below Calculate approximate values of Tr, Ts,Tp,Mp.



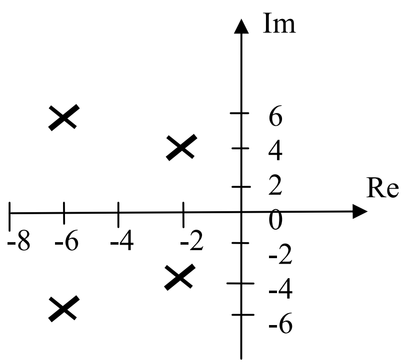


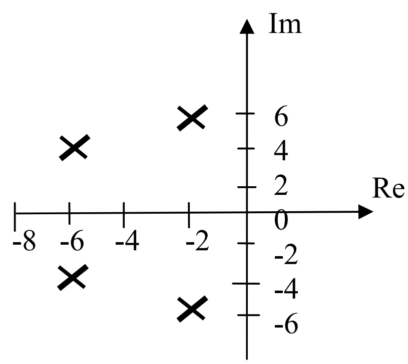
6)The input to the following system is r(t)= 10u(t) (u(t) is step function). The output are given below Calculate approximate value of e_{ss} steady state error.

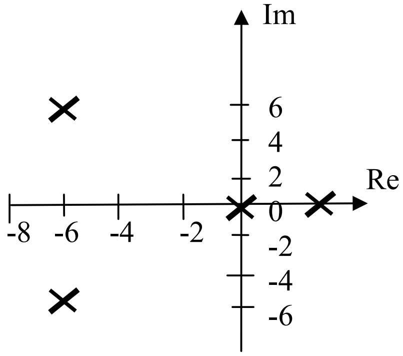


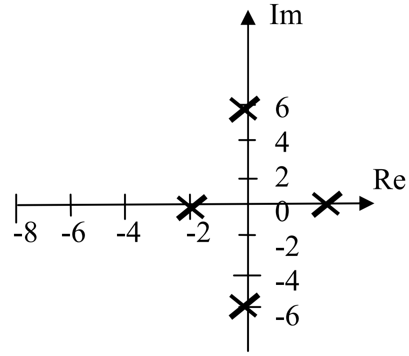


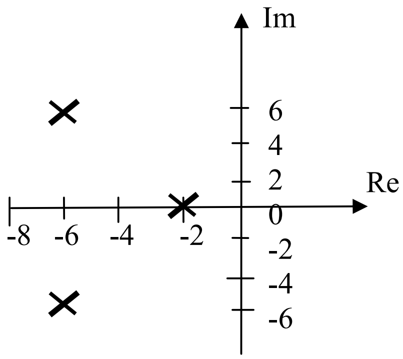
7)The poles of linear systems are shown below. Write the **approximate** values of dominant roots for each system.

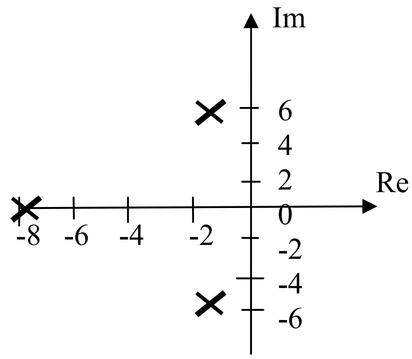




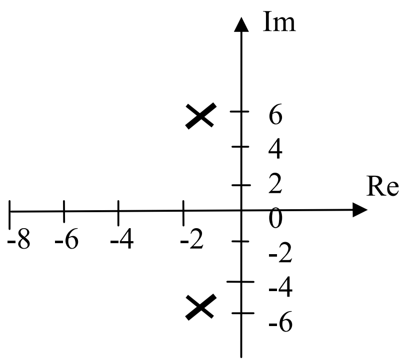


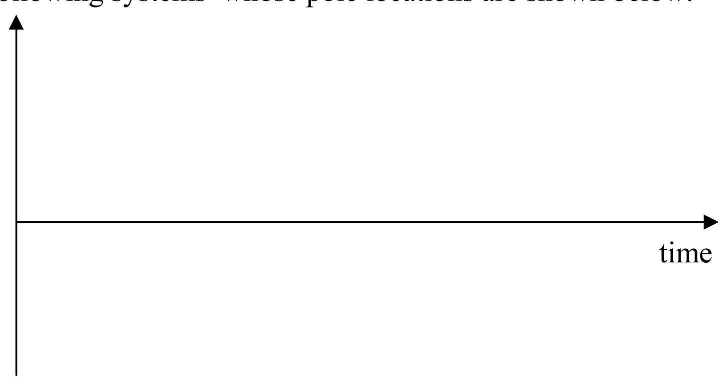


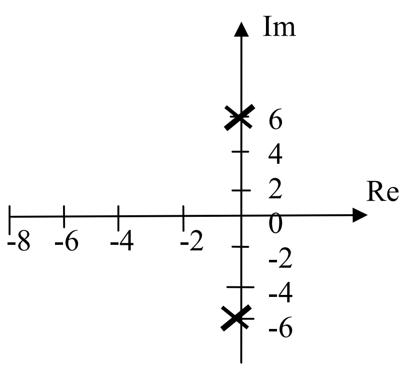


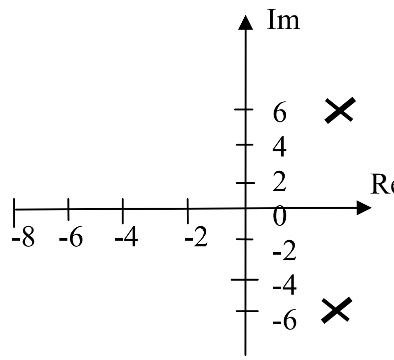


8)Draw approximate step response for the following systems whose pole locations are shown below.



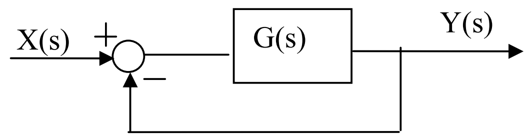






9)Using Routh Hurwitz creteria , find the values of K that the following system is stable

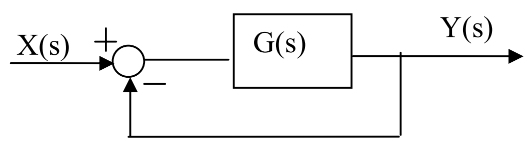
$$G(s)=\frac{K}{(s+1)(s+2)(s+4)}$$



10)Draw approximate root locus for the following system

$$G(s)=\frac{K(s+1)}{s(s+2)(s+4)^2}$$

11)The gain and pole locations are shown in the following figure. Calculate G(s)



K	S_1	S_2
0	-3.	-2.
0.1	-2.6	-2.5
0.11	-2.55-0.148j	-2.55+0.148j
0.15	-2.6 - 0.34i	-2.6 + 0.34i
0.2	-2.6 - 0.49i	-2.6 + 0.49i
1.	-3.- 1.4i	-3. + 1.4i
1.5	-3.25 - 1.7i	-3.2 + 1.7i
2.	-3.5 - 1.9i	-3.5 + 1.9i
5.	-5. - 2.4i	-5. + 2.4i
8.	-6.5 - 1.9i	-6.5 + 1.9i
9.8	-7.4- 0.49i	-7.4 + 0.49i
9.8990	-7.4 4	-7.45
9.9	-7.4	-7.5
10.	-7.	-8.
100	-5.063	-99.9
1000	-5.006	-999.9
10000	-5.0006	-9999.9
100000	-5.000001	-999999.9

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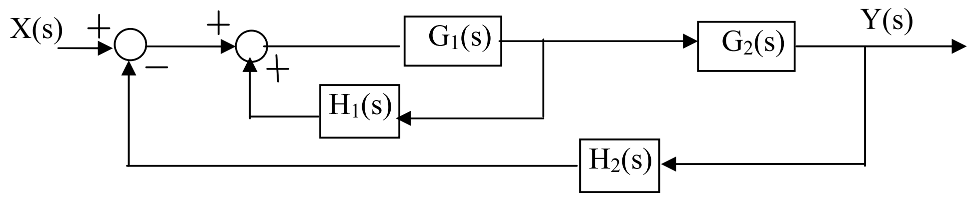
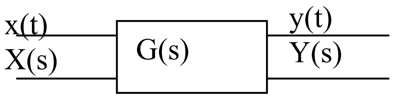
2) Find the transfer function $\frac{Y(s)}{X(s)}$ of the following system.

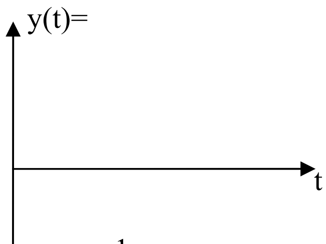


3) $X(s)=\frac{3s^2+2s-11}{s^3+7s^2+25s+39}=\frac{2s-8}{s^2+4s+13}+\frac{1}{s+3}$ Calculate x(t)

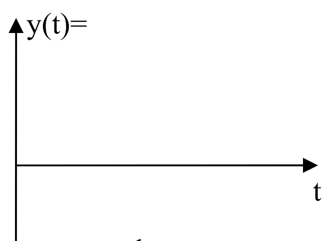
4)Calculate and draw the output y(t) if the input is x(t)=δ(t). Write the output y(t) on the figure.



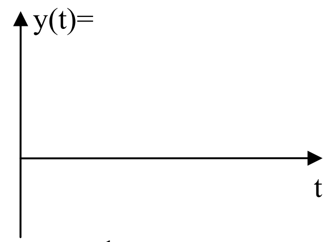
$s^2+4s+13=0 \rightarrow s_1=-2+3i, \ s_1=-2-3i$
$s^2-4s+13=0 \rightarrow s_1=2+3i, \ s_1=2-3i$



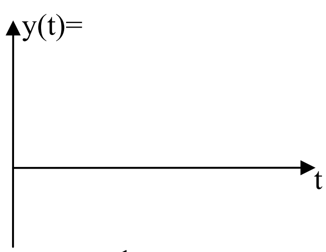
a)$G(s)=\frac{1}{s+1}$



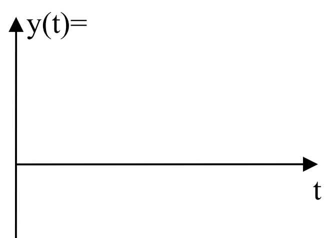
b)$G(s)=\frac{1}{s^2+1}$



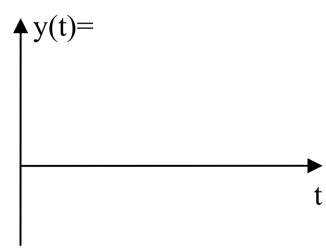
c)$G(s)=\frac{1}{s^2-1}$



d)$G(s)=\frac{1}{s-1}$



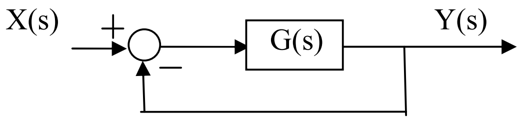
e)$G(s)=\frac{1}{s^2+4s+13}$



e)$G(s)=\frac{1}{s^2-4s+13}$

5)Write state space equations for the differential equation $\frac{d^3x}{dt^3}=U$, y=x, U:input, y:output

7) Calculate e_{ss}, for the following closed loop system. $G(s)=\frac{s+1}{s^2+4s+4}$,

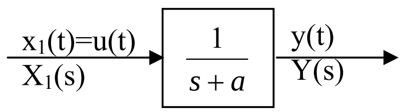


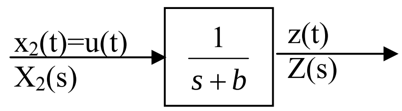
8)The benefits of feedback are

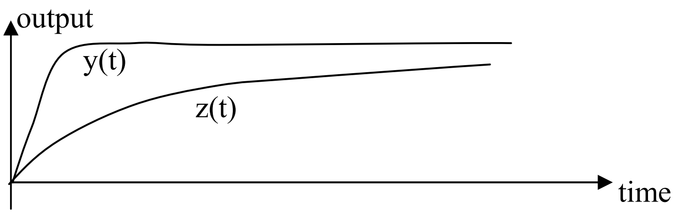
a)
b)
c)
d)

Write the answer in terms of (sensitivity, stability, steady state error, transient analysis(peak time, rise time, settling time) .

9) y(t) and z(t) are step response of the following systems (u(t):step function)





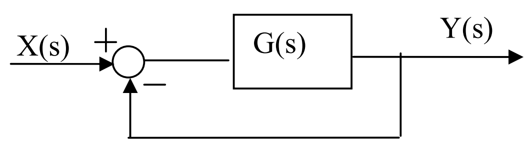


State True or False

a) $|a|>|b|$
b) $a<0, \quad b<0$
c) $\lim_{t\to\infty} y(t) = \lim_{t\to\infty} z(t)$
d) $\lim_{t\to\infty} y(t)=1$

10)Using Routh Hurwitz creteria , find the values of K that the following system is stable

$$G(s)=\frac{K(s-2)}{(s+1)(s+2)(s+4)}$$



11) Draw root locus for the following system.

$$G(s)=\frac{K(s+1)(s+2)}{s^2(s+5)(s+7)}$$