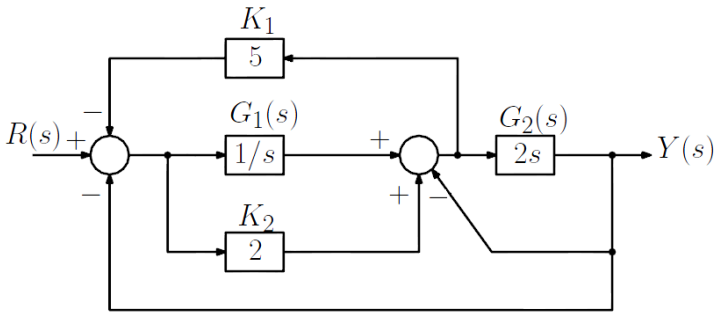
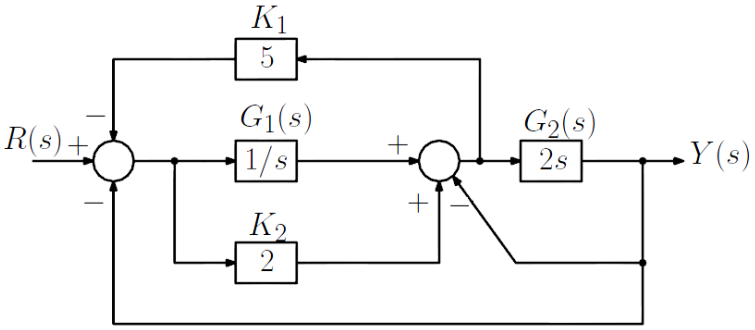
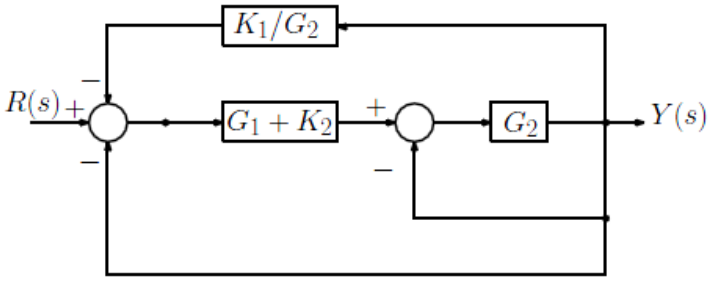
MAK4391 OTOMATİK KONTROL 1 ÇALIŞMA SORULARI

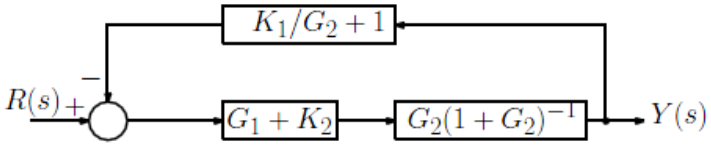
1-) Aşağıda blok diyagramı verilen sistem için Y(s)/R(s) transfer fonksiyonunu bulunuz.

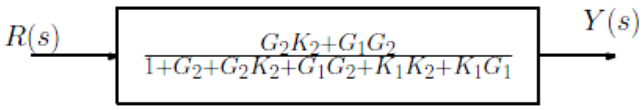


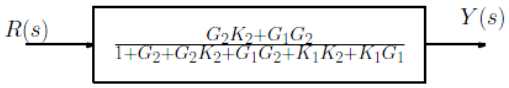
ÇÖZÜM: Aşağıda blok diagramı verilen sistem için Y(s)/R(s) transfer fonksiyonu,









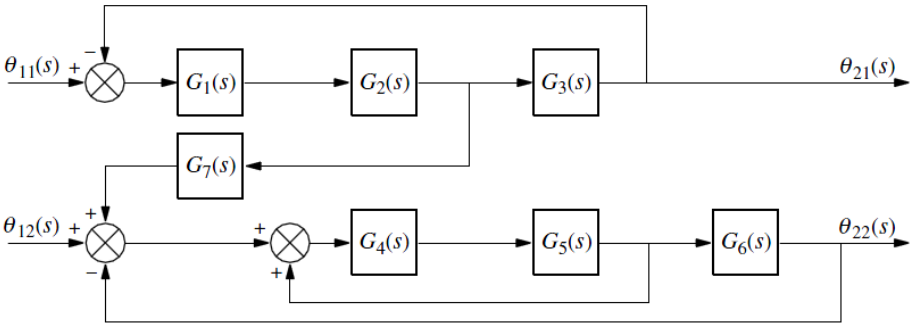


Bu durumda sistem K.Ç. transfer fonksiyonu

$$\frac{Y(s)}{R(s)} = \frac{(4s+2)s}{6s^2+13s+5}$$

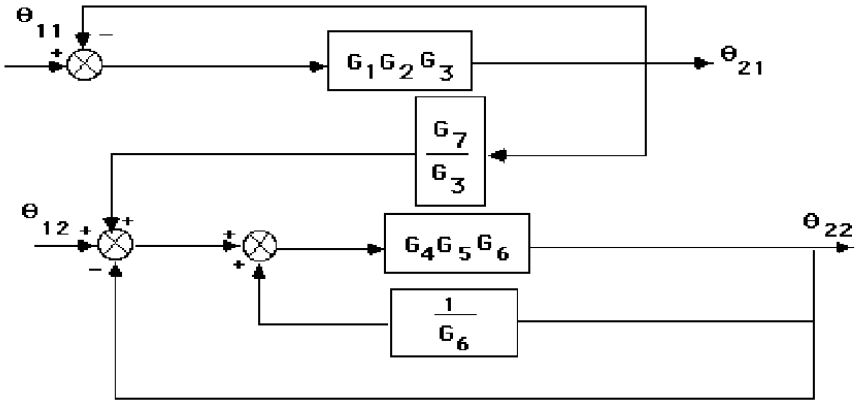
şeklinde elde edilir.

2-) Aşağıda blok diyagramı verilen sistem için T(s):=$\theta_{22}(s)$ / $\theta_{11}(s)$ kapalı-çevrim transfer fonksiyonunu hesaplayınız?

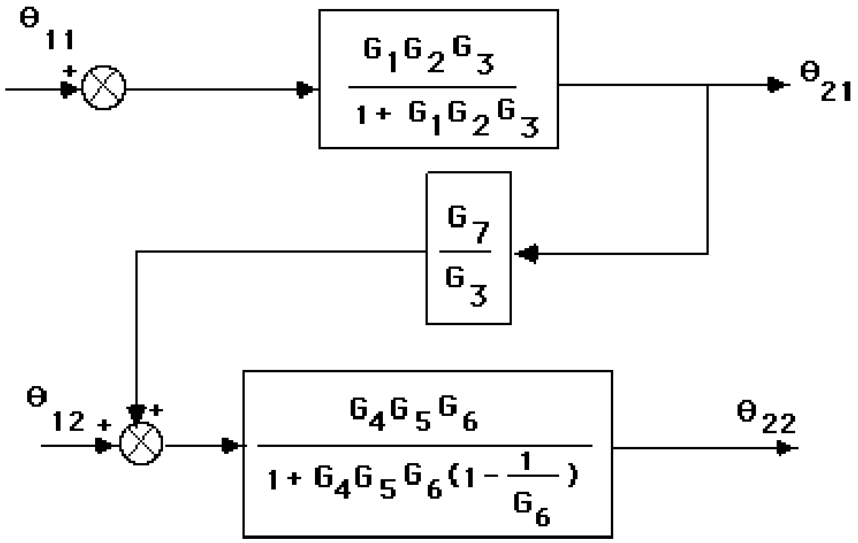


ÇÖZÜM:

Push G_3 to the left past the pickoff point. Push G_6 to the left past the pickoff point.



Hence,



Thus the transfer function is the product of the functions, or

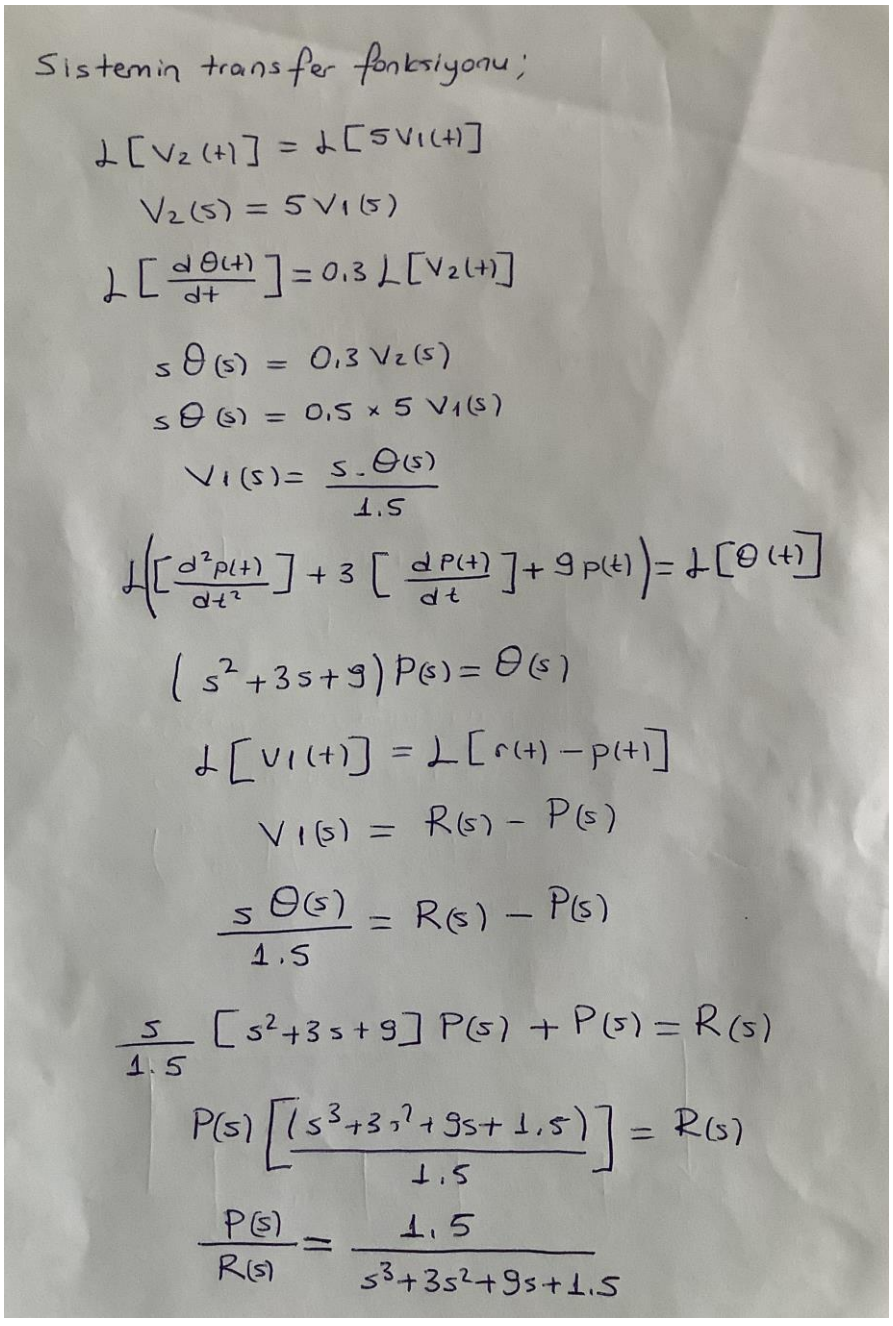
$$\frac{\theta_{22}(s)}{\theta_{11}(s)} = \frac{G_1G_2G_4G_5G_6G_7}{1 - G_4G_5 + G_4G_5G_6 + G_1G_2G_3 - G_1G_2G_3G_4G_5 + G_1G_2G_3G_4G_5G_6}$$

3-) Uzay aracı fırlatma platformunun diferansiyel denklemleri,

$$\frac{d^2p(t)}{dt^2} + 3\frac{dp(t)}{dt} + 9p(t) = \theta(t)$$
$$v_1(t) = r(t) - p(t)$$
$$\frac{d\theta(t)}{dt} = 0.3v_2(t)$$
$$v_2(t) = 5v_1(t)$$

şeklinde tanımlanmıştır. Burada, ***r*(t)** referans platform pozisyonu, ***p*(t)** platformun gerçek pozisyonu, ***v*$_1$(*t*)** amplifikatörün giriş gerilimi, ***v*$_2$(*t*)** amplifikatörün çıkış gerilimi ve $\theta(t)$ motor şaftının açısal pozisyonudur. Sistemin transfer fonksiyonunu **(P(s) / R(s))** bulunuz.

ÇÖZÜM:



4-) Aşağıda verilen diferansiyel denklemi çözerek x(t) yörünge denklemini bulunuz. Sistemin tüm başlangıç koşulları sıfır olarak alınacaktır.

$$\frac{d^2x}{dt^2}+4\frac{dx}{dt}+5x=u(t)$$

ÇÖZÜM:

$$\mathcal{L}\left\{\frac{d^2x}{dt^2}\right\}+4\,\mathcal{L}\left\{\frac{dx}{dt}\right\}+5\,\mathcal{L}\{x\}=\mathcal{L}\{u(t)\}$$

$$\Rightarrow s^2X(s)-s\,x(0)-\dot{x}(0)+4\left[sX(s)-x(0)\right]+5X(s)=\frac{1}{s}$$

$$\Rightarrow s^2X(s)-0-0+4\left[sX(s)-0\right]+5X(s)=\frac{1}{s}$$

$$\Rightarrow s^2X(s)+4sX(s)+5X(s)=\frac{1}{s}$$

$$\Rightarrow (s^2+4s+5)X(s)=\frac{1}{s}$$

$$\Rightarrow X(s)=\frac{1}{s(s^2+4s+5)}$$

$$X(s)=\frac{1}{s(s^2+4s+5)}=\frac{A}{s}+\frac{Bs+C}{(s^2+4s+5)}$$

$$1=A(s^2+4s+5)+(Bs+C)s$$

$$s=0:\quad 1=5A\Rightarrow \underline{\underline{A=\frac{1}{5}}}$$

$$s=1:\quad 1=10A+B+C$$
$$\Rightarrow 1=10\times\frac{1}{5}+B+C$$
$$\Rightarrow 1=2+B+C$$
$$\Rightarrow B+C=-1$$

$$s=2:\quad 1=17A+4B+2C$$
$$\Rightarrow 1=17\times\frac{1}{5}+4B+2C$$
$$\Rightarrow 1-\frac{17}{5}=4B+2C$$
$$\Rightarrow 4B+2C=-\frac{12}{5}$$

$$4B+2C=-\frac{12}{5}$$

$$2B+2C=-2$$

$$2B=-\frac{12}{5}-(-2) \quad \Rightarrow 2B=-\frac{12}{5}+2 \quad \Rightarrow 2B=-\frac{2}{5} \quad \Rightarrow \underline{\underline{B=-\frac{1}{5}}}.$$

$$B+C=-1 \Rightarrow -\frac{1}{5}+C=-1 \Rightarrow C=-1+\frac{1}{5} \Rightarrow \underline{\underline{C=-\frac{4}{5}}}$$

$$X(s)=\frac{1}{5s}-\frac{s+4}{5(s^2+4s+5)}$$

$$\Rightarrow X(s)=\frac{1}{5}\left\{\frac{1}{s}-\frac{s+4}{(s^2+4s+5)}\right\}.$$

$$X(s)=\frac{1}{5}\left\{\frac{1}{s}-\frac{s+4}{(s+2)^2-2^2+5}\right\}$$

$$\Rightarrow X(s)=\frac{1}{5}\left\{\frac{1}{s}-\frac{s+4}{(s+2)^2+1}\right\}$$

$$X(s)=\frac{1}{5}\left\{\frac{1}{s}-\frac{s+2+2}{(s+2)^2+1}\right\}$$

$$\Rightarrow X(s)=\frac{1}{5}\left\{\frac{1}{s}-\frac{s+2}{(s+2)^2+1}-\frac{2}{(s+2)^2+1}\right\}.$$

$$X(s)=\frac{1}{5}\left\{\frac{1}{s}-\frac{s+2}{(s+2)^2+1}-2\frac{1}{(s+2)^2+1}\right\}.$$

$$\underline{\underline{x(t)=\frac{1}{5}[1-e^{-2t}\cos(t)-2e^{-2t}\sin(t)]\,u(t).}}$$