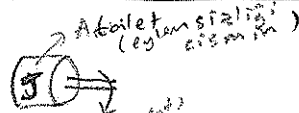


Dönel Hareket → elektrik motoru gibi  
 2. v motoru için  
 - J atalet momenti  
 - B sürtme katsayısı  
 - m yükü  
 - Ra armatür direnci

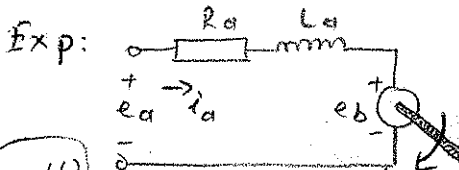
İşaret Akış Grafikleri  
 (Maddenin İndirgenmesi)

$F = m \cdot a$

**Moment =  $T = J \cdot \alpha$**



$T = J \cdot \alpha = J \frac{d\omega(t)}{dt} = J \frac{d^2\theta(t)}{dt^2}$   
 (  $m \cdot a = m \frac{dx(t)}{dt} = m \frac{d^2x(t)}{dt^2}$  )



Motorun girişi  $E_b = K_b \cdot \omega_m$  → acısal hız  
 $T_m = J \cdot \alpha$  → Motor Torku  
 $T_L$  yük torku  
 istenmeyen tork toplama

$\alpha = \frac{d\omega(t)}{dt}$   
 $\theta = \int \omega(t) dt$   
 $q = \frac{d^2\theta(t)}{dt^2}$

Ans:  $e_a - e_b = R_a i_a + L_a \frac{di_a}{dt}$

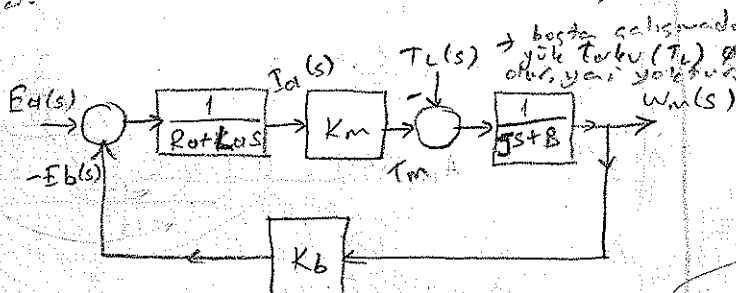
$\Rightarrow E_a(s) - E_b(s) = R_a I_a(s) + L_a s I_a(s)$

$\Rightarrow E_a(s) - E_b(s) = I_a(s) [R_a + L_a s]$

$T_m(s) = J \frac{d\omega_m}{dt} + B \omega_m + T_L$  (load torque)  $\rightarrow$   $\omega_m(s)$

$\Rightarrow T_m(s) = J \cdot s \cdot \omega_m(s) + B \omega_m(s) + T_L(s)$

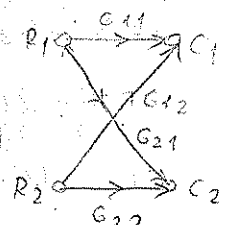
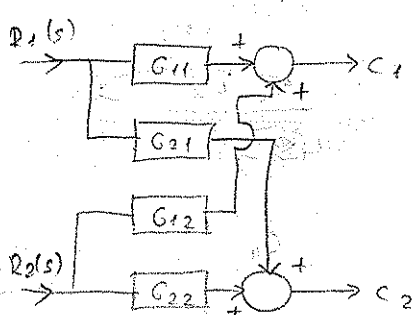
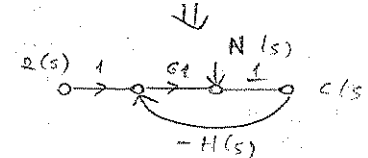
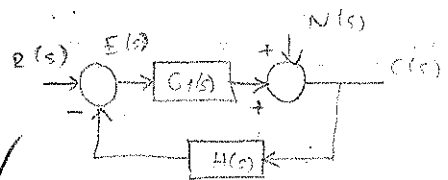
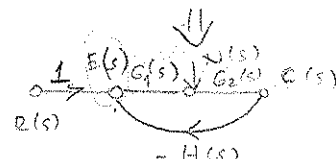
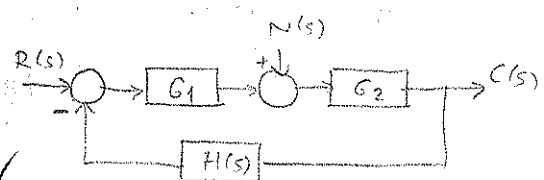
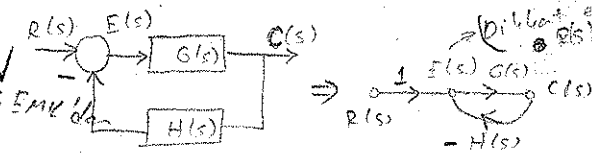
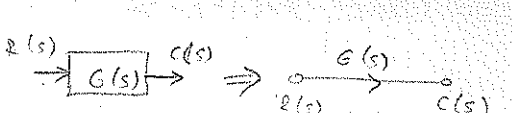
$\Rightarrow T_m(s) - T_L = \omega_m(s) (J s + B)$



Bu sonuçta stabilite için  $\frac{1}{K_m}$  butunmalıdır.

$\frac{\omega_m(s)}{E_a(s)} = \frac{E_d(s) + C_{T_L} T_L(s)}{s^2 L_a J + s(L_a B + J R_a) + K_m R_a B}$

$\omega_m = C_{E_a} E_a + C_{E_{T_L}}$



$T_L$  olursa idi (motor yüküne iten) bu terim de eklenirdi

Bu sonuçta stabilite için  $\frac{1}{K_m}$  butunmalıdır.

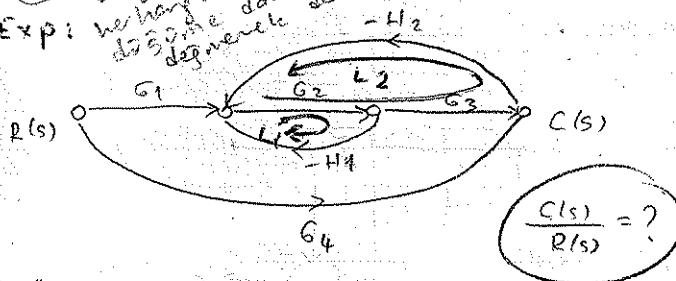
$$TF = \frac{X_{\text{çıkış}}}{X_{\text{giriş}}} = \frac{\sum_{k=1}^n P_k \Delta_k}{\Delta} = \frac{P_1 \Delta_1 + P_2 \Delta_2 + \dots + P_n \Delta_n}{\Delta}$$

$$\Delta = 1 - \left( \begin{array}{l} \text{Bütün farklı} \\ \text{cevrimlerin} \\ \text{kazancalarının} \\ \text{toplamı} \end{array} \right) + \left( \begin{array}{l} \text{Temsiz} \\ \text{cevrim} \\ \text{kazancalarının} \\ \text{2'şer 2'şer} \\ \text{kazancaların} \\ \text{çarpımının} \\ \text{toplamı} \end{array} \right) - \left( \begin{array}{l} \text{Temsiz} \\ \text{cevrim} \\ \text{kazancalarının} \\ \text{3'şer 3'şer} \\ \text{kazancalarının} \\ \text{çarpımının} \\ \text{toplamı} \end{array} \right) + \dots - \dots$$

$P_k \Rightarrow k$  numaralı iletişim yolları  
 $n \Rightarrow$  Temsiz yolların toplam sayısı

$$\Delta_k = 1 - \left( \begin{array}{l} P_k \text{ iletişim yolları} \\ \text{ailelerinden} \\ \text{sarıya} \\ \text{yollar ve çıkışları} \\ \text{ve yollar} \\ \text{değmeyen} \\ \text{kazancalarının toplamı} \end{array} \right) + \left( \begin{array}{l} \text{Bütün} \\ \text{değmeyen} \\ \text{kazancalarının} \\ \text{2'şer} \\ \text{2'şer çarpımının} \\ \text{toplamı} \end{array} \right) - \left( \begin{array}{l} \text{Bütün} \\ \text{değmeyen} \\ \text{kazancalarının} \\ \text{3'şer 3'şer} \\ \text{çarpımının} \\ \text{toplamı} \end{array} \right) + \dots - \dots$$

Exp: her yola değmeyen bir diziye dahil değildir.



$$\frac{C(s)}{R(s)} = ?$$

Ans:

$$\begin{cases} P_1 = G_1 G_2 G_3 \\ P_2 = G_4 \\ L_1 = -G_2 H_1 \\ L_2 = -G_2 G_3 H_2 \end{cases}$$

$\Delta_1$  ve  $\Delta_2$ 'si bulurken  $L_1$  ve  $L_2$  işe yaramaz.

$$\Delta = 1 - (L_1 + L_2) + (0) = 1 - (-G_2 H_1 - G_2 G_3 H_2) = 1 + G_2 H_1 + G_2 G_3 H_2$$

$$\Delta_1 = 1 - 0$$

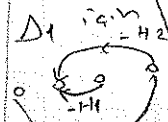
$$\Delta_2 = 1 - (-G_2 H_1) = 1 + G_2 H_1$$

$\frac{C(s)}{R(s)}$  biz artık bulabiliriz.

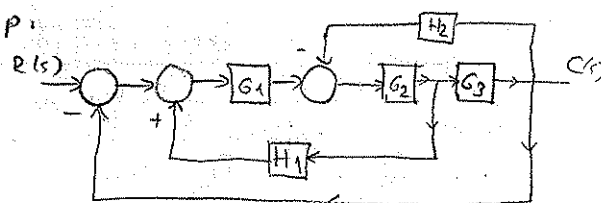
$$\frac{C(s)}{R(s)} = \frac{\sum P_i \Delta_i}{\Delta} = \frac{G_1 G_2 G_3 \cdot 1 + G_4 (1 + G_2 H_1)}{1 + G_2 H_1 + G_2 G_3 H_2}$$

Temsiz cevrimler her bir ortak değere değecek değildir.

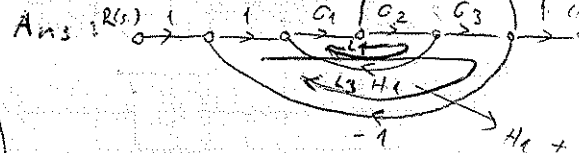
2'şer 2'şer 2 tane ile veya  $\Delta_1$  ve  $\Delta_2$  olur.



Exp:



$$\frac{C(s)}{R(s)} = ?$$

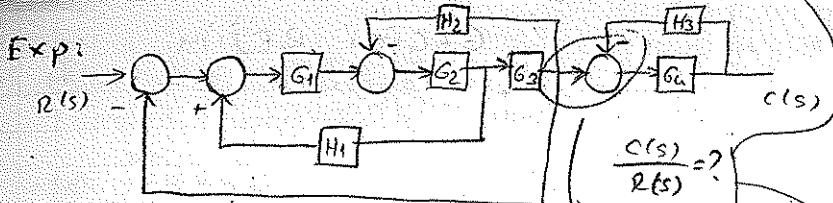


$$\begin{cases} P_1 = G_1 G_2 G_3 \\ L_1 = G_1 G_2 H_1 \\ L_2 = -G_2 G_3 H_2 \\ L_3 = -G_1 G_2 G_3 \end{cases}$$

$$\Delta = 1 - (L_1 + L_2 + L_3) + (0)$$

$\Delta_1 = 1 - 0$  neden 0? çünkü  $G_1 G_2 G_3$  ve  $L_3$  gidince aynı bütün değişkenler temsiz kazancaların bir çarpımı ve aynı temsiz ve aynıdır.

$$\frac{C(s)}{R(s)} = \frac{G_1 G_2 G_3}{1 - (G_1 G_2 H_1 - G_2 G_3 H_2 - G_1 G_2 G_3)}$$



$$\Delta = 1 - (L_1 + L_2 + L_3 + L_4 + L_5 + L_6 + L_7 + L_8) + (L_5 L_4 + L_5 L_7 + L_3 L_4)$$

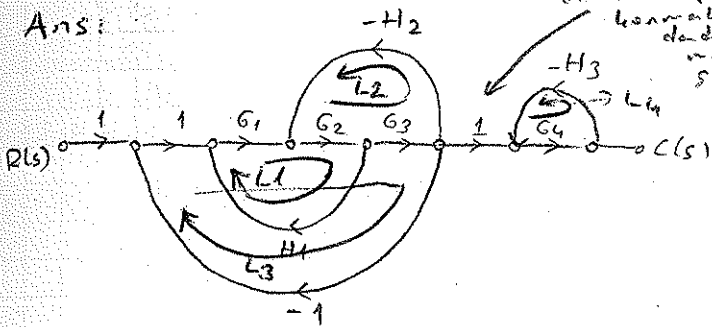
$$\Delta_1 = 1 - (0)$$

$$\Delta_2 = 1 - (L_5)$$

$$\Delta_3 = 1 - (0)$$

$$\frac{C(s)}{R(s)} = \frac{P_1 + P_2 - P_2 L_5 + P_3}{1 - (L_1 + L_2 + L_3 + \dots)}$$

Ans:



$$P_1 = G_1 G_2 G_3 G_4$$

$$L_1 = G_1 G_2 H_1$$

$$L_2 = -G_2 G_3 H_2$$

$$L_3 = -G_1 G_2 G_3$$

$$L_4 = -G_4 H_3$$

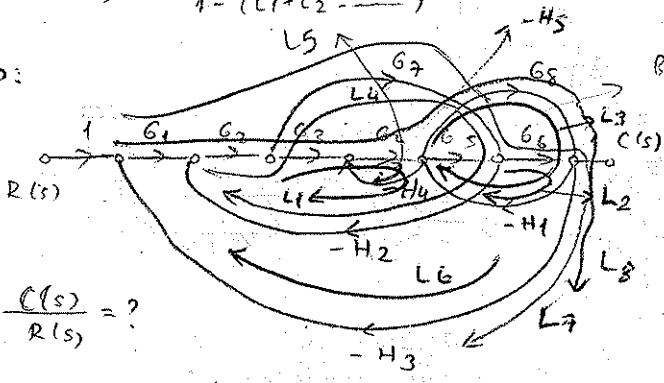
illa ki laetle H o laetle diyo bishet jeta mesela bivada H lerim yaktun temassiz laer ilise ilise disa gur deapatale sepin

$$\Delta = 1 - (L_1 + L_2 + L_3 + L_4) + (L_4 L_1 + L_4 L_2 + L_4 L_3)$$

$$\Delta_1 = 1 - 0$$

$$\frac{C(s)}{R(s)} = \frac{G_1 G_2 G_3 G_4}{1 - (L_1 + L_2 + \dots)}$$

Exp:



$$\frac{C(s)}{R(s)} = ?$$

Ans:

$$P_1 = G_1 G_2 G_3 G_4 G_5 G_6$$

$$P_2 = G_1 G_2 G_7 G_6$$

$$P_3 = G_1 G_2 G_3 G_4 G_8$$

$$L_1 = -G_2 G_3 G_4 G_5 H_2$$

$$L_2 = -G_5 G_6 H_1$$

$$L_3 = -G_8 H_1$$

$$L_4 = -G_2 G_7 H_2$$

$$L_5 = -G_4 H_4$$

$$L_6 = -G_1 G_2 G_3 G_4 G_5 G_6 H_3$$

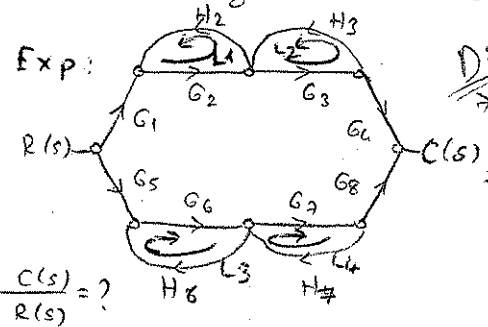
$$L_7 = -G_1 G_2 G_7 G_6 H_3$$

$$L_8 = -G_1 G_2 G_3 G_4 G_8 H_3$$

L5 → L4, L7  
L3 → L4

~~Exp~~ Sinavda

Soru soyle gelir: Bir sekil verilir ve bunun transfe farkli Masson indirgenesi ile bulunur.



$$\frac{C(s)}{R(s)} = ?$$

Ans:

$$P_1 = G_1 G_2 G_3 G_4$$

$$P_2 = G_5 G_6 G_7 G_8$$

$$L_1 = G_2 H_2$$

$$L_2 = G_3 H_3$$

$$L_3 = G_6 H_6$$

$$L_4 = G_7 H_7$$

$$\Delta = 1 - (L_1 + L_2 + L_3 + L_4) + (L_1 L_3 + L_1 L_4 + L_2 L_3 + L_2 L_4)$$

$$\Delta_1 = 1 - (L_3 L_4)$$

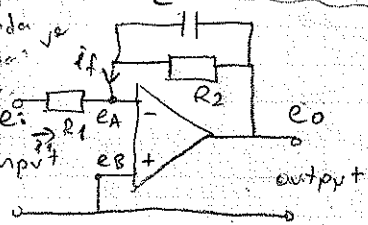
$$\Delta_2 = 1 - (L_1 L_2)$$

Bunlara dihhent gadece ileri ka parlar diye Wey yul, temassiz ism cevrim ka parlar vardi

$$\frac{C(s)}{R(s)} = \frac{P_1 - P_1 L_3 L_4 + P_2 - P_2 L_1 L_2}{1 - (L_1 + L_2 + L_3 + L_4) + (L_1 L_3 + \dots)}$$

Hw

OGAT A tirabi Sayfa 120 da vizag sorular ve deaplan vardi Bu soru haric! Vardim? cozecegiz?



R1C = 0,5 sn  
R2C = 1 sn  
T.F. bulunur?

Hw: Sinav soru cozumleri hocamiza kağıtta ider olarak gunula- caktır.