$$\mu(s) = \frac{s^2 + 5s + 6}{s^2 + 6s^2 + 18s + 40}$$
 Pout 1

$$\frac{S^{2}+58+6}{(5+4)(5^{2}+28+10)} = \frac{S^{2}+59+6}{(5+4)(5-(-1-3i))(5-(-1+3i))}$$

- : The real polit of the lytter lin at 2=-4. and there are 20ther complex poles -1-3i, -1+3i
- I have used Routh- huwity cuileurg fou slabelely 30 in the charactentic eq , 83+ 652+185+40 all coefficient are of Seme Sign and all bower of I from 8 to 0 are present thus it is a knowled to polynomial 4000 cuesting the Routh's aurey

$$\frac{6}{6}$$
 = $\frac{18(6)-40}{6}$ = $\frac{18-20/3}{6}$ = $\frac{34/3}{6}$, $\frac{6}{12}$ = $\frac{0-0}{6}$

$$q = \frac{34(40)}{34/3} = 40$$

$$c_1 = \frac{6-0}{34|3} = 0$$

now in the find column of the annay their conno years and they is no sign change that by humanity mooth culous we can alsume that the system is stable.

Courses + wien = (2) H .:

Propred to the state

mublicus, tegri

. with the pole analysis too use can be that of them are in help been and thus system is stable

The puelence of complex poles sugget that there are going to be oscillation in the system

$$H(S) = \frac{S^{2} + 58 + 6}{(S + 4)(S^{2} + 28 + 10)} = \frac{A}{(S + 4)(S + 4)} + \frac{88 + C}{(S^{2} + 28 + 10)}$$

$$S^{2} + 58 + 6 = A(S^{2} + 28 + 10) + (82 + C)(S + 4)$$

$$S = -4$$

$$16-20+6 = A(16-8+10) + 0$$

 $2 = A(18) \Rightarrow A = 19$

$$6 = A(10) + CO(4)$$
 $6 - 10/9 = 4C$
 $= 40/9 = 40$
 $= 40/9 = 40$

$$72 = A(9) + \frac{11}{3} - 3B$$

:
$$H(s) = \frac{1}{9(s+4)} + \frac{8s+11}{9(s^2+2s+10)}$$

Hele the colletis hund

$$N(S) = \frac{S^2 + 58 + 6}{(S+4)(S^2 + 28 + 10)} = \frac{\frac{S^2 + 58 + 6}{(S+4)}(\frac{1}{S^2 + 28 + 10})^{10}}{\frac{10}{(S+4)}(\frac{10}{S^2 + 28 + 10})}$$

$$= \frac{10(S^2 + 58 + 6)}{10(S+4)}(\frac{10}{S^2 + 28 + 10})^{10}$$

Cascadiny of two syllans

$$\frac{10(8^{2}+58+6)}{10(8+4)} \rightarrow \frac{10/(8^{2}+28+10)}{10(8+10)}$$

$$= \frac{(3^{2}+23)^{8}-31)A}{1+\frac{10!}{3^{2}+23}} = 3+09-31$$

thus according to walls of block diagnam ourabyen we cando

$$\frac{R(s)}{\frac{(s+2)(s+3)}{10(s+4)}} \xrightarrow{\uparrow} \frac{10/(s^2+2s)}{\uparrow} \frac{10/(s^2+2s)}{\uparrow} \frac{10/(s^2+2s)}{\uparrow}$$
input Juanducer

I funther buskdowy

. your toe analyse the second ander system as 52+28+10 (32+220ns+(un)2) where on=natural furquency L= damping matio (1) 3月15日 (1) 113月 :. (w w = 1/10 m L=0() \10 < 1 => Bu eysten is mider damped : peak time = $\frac{9}{\omega_n \sqrt{1-L^2}} = \frac{8.14}{\sqrt{10}} = 0.950cc. 1.046 sec.$ settling time ~ 4/write = 4 = 4 sec. or -In(0.02) = 3.91 sec. e-Ln/VI-R2 x100 = 35.11%. 1/ sull hoot = so we can see that the overloot it, is quite high than the pulcuited 10-20%. [(是是)] # 整理型] 801. Lift + Pith En Taxx. S (A) (40-A) 8

Maximum oueuthooting % = 15 222) 100/01 = Parts Manimum Sottlebing time = 30 from the eq' of contral system we know Settleing time = $\frac{-\ln(0.02)}{L\omega_n} \le 3$ and $e^{-L_1/\sqrt{1-L^2}} \le 0.15$ when L= clauping co-efficient, who = natural furquery e-by/J-12 50.15 $\frac{1}{\sqrt{1-L^2}} \leq \ln(0.15) \Rightarrow \frac{-L\pi}{\sqrt{1-L^2}} \leq -1.89$ $\frac{1}{\sqrt{1-l^2}} \ge 1.89 \implies \frac{1}{\sqrt{1-l^2}} \ge 0.6$ = L2 0.36-0.36 L2 = 1.36 L² 2 0.36 7 L2 0.264 日 九之 0.513 $\frac{-\ln(0.02) \le L}{3\omega_n}$ $\Rightarrow -\ln(0.02) \leq 0.513$ 3.912 5 Wh = | Wh ? 2.54 mad) 3 Wu

$$h(3) = \frac{3^2 + 53 + 6}{3^3 + 63^2 + 189 + 40}$$

$$= \frac{3^{2}+53+6}{(3+4)(3^{2}+23+10)}$$

$$= \frac{3^{2}+53+6}{(3+4)(3-(-1+3i))(3-(-1+3i))}$$

:. The real polit of the eyeter lin at z=-4 and there are 20ther complex poles -1-3i, -1+3i

I have used Routh-Humisty cuitered four slabely so in the characteristic egt 83+ 652+185+40 all coefficient are of some sign and all power of s from 3 to 0 are present thus it is a humanity polynomial now are the Routh's away

5³ 1 18 0 5² 6 40 0 5 6,(34/3) 62(0) 0 5 9 (40) 0

$$b_1 = 18(6) - 40 = 18 - 20/3 = 34/3, b_2 = 8-0$$

$$q = \frac{34(40)}{34/3} = 40$$

$$c_1 = \frac{6-6}{34|3} = 0$$

now in the find column of the array there towns gers and they is no sign change that by knowity rooth culoura we can allume that the Eyslow is Stable.

(PHENES)E " (PAE)P = (2)/1:

bush ather are us significant

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. with the pole analysis too use can ce that of them are in help half plane and time system is Hable The pulluce of complex poles higger that there are going to be oscillation in the sylten

•
$$N(s) = \frac{s^2 + 5s + 6}{(s + 4)(s^2 + 2s + 10)} = \frac{A}{(s + 4)(s + 2s + 10)} + \frac{Bs + C}{(s^2 + 2s + 10)}$$

$$3=-4$$
 $16-20+6=A(16-8+10)+0$
 $2=A(18) \Rightarrow A=19$

$$6 = A(10) + (C)(4)$$
 $6 - 10/9 = 4C$
 $= 40/9 = 40$
 $= 40/9 = 40$

$$8-1$$
 $8=-1$ $1-S+6=A(1-2+10)+(C-B)(3)$

$$7 \cdot 2 = A(9) + \frac{11}{3} - 3B$$

 $7 \cdot 1 - 11/3 = -3B = 8 = 8/9$

. your toe analyse the lecond ander gystem as 32+28+10 (32+220ns+(un)2) where $\omega_n = natural furquency$ $f \ge damping value.$: 00 Wn = 1/10

L=0<1/10<1 = Strybe explain is empley damped. : peak time = $\frac{9}{\omega_{h}\sqrt{1-\mu^{2}}} = \frac{8.14}{\sqrt{10}\sqrt{1-\frac{1}{10}}} = \frac{0.950 \text{ GeV}}{\sqrt{10}} = \frac{1.046 \text{ Sec.}}{\sqrt{10}}$ Settling time $\approx 4/\omega_n R = \frac{4}{\sqrt{10}} = 4 \sec \sigma = \frac{-\ln(0.02)}{\omega_n L} = 3.91 \sec \sigma$ 1. ouenshoot = e-Ln/VI-L2 x100 = 35.11%. so we can su that the orienthoot 7, is quite high than the puscuited 10-20%. 178-138 + 18 (2-31) 13:4911 113000 Pringle Sui 7 (A) (10-3) 8

Manimum Sotleling time = 35 Maximum oueushooting % = 15 2220 000 = Parts from the eq' of contral system we know Settleing time = $\frac{-\ln(0.02)}{L\omega_n} \le 3$ & (18.2) or = and $e^{-L\pi/\sqrt{1-L^2}} \le 0.15$ when L= clausing co-efficient, wn= natural furquency e-12/1-12 50.15 = 12 21.89 = 1-12 0.6 = 12 0.36 - 0.36 L2 7 1.36 L2 > 0.36 7 L2 0.264 9 12 0.513 · - In(0.02) ≤ L 3wn = -In(0.02) < 0.513 3(0.513) Swn = | wn > 2.54 mad

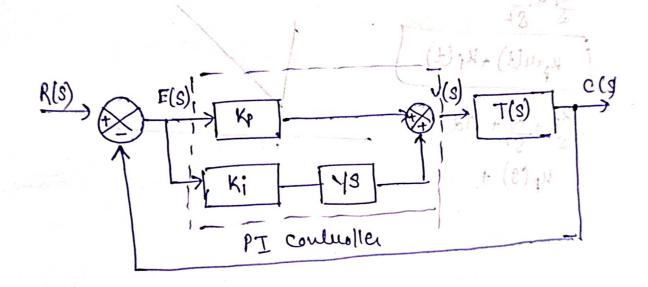
· The H(9) transfer of far a PI of controller looks &

Kp = Purpontional gain

4 = inlegnatar gain.

Hu Kp and Kt au lund mig the Simuliak PID tuney

· A schematic diagram of the into system in ques



19/11

Hu Phale gain oflained 15 = 45.9° $K_{T} = 27.4096$.