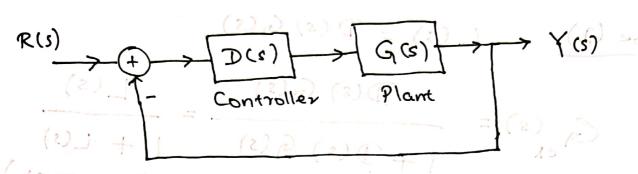
PERFORMANCE OF CLOSED-LOOP SYSTEM 9001-6-8 STEADY STATE ERROR ANALYSIS



Whity of endback System

$$R(z) \longrightarrow (z) \longrightarrow (z)$$

(2)
$$g$$
(2) g
(2) g
(3) g
(4) g
(5) g
(5) g
(5) g
(6) g
(7) g
(8) g
(8)

is called type-1 system.

l indicates number of poles of L(s) at 11/5=0.

note that lilling may be positive or negative.

Our interest is

grows time closed-loop system. who ress

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and analyze the steady state error classy-loop system output.

PERFORMANCE OF CLOSED-LOOP
Transfer function of closed-loop
STEADY STATE ERROR ANALYSIST
SYSTEM.

$$Cose(2) = D(s) G(s)$$

$$G(s) = D(s) G(s)$$

$$G(s) = (2) G(s)$$

$$G(s) = (3) G(s)$$

$$G(s) = (4) G(s)$$

$$G(s)$$

(For stability of CLS: Roots of (1+L(1)=0 be in LHS)

Error signal \triangle e(t) = $\gamma(t) - \gamma(t)$

$$E(s) = R(s) - V(s)$$

$$= R(s) - L(s)E(s)$$

$$\frac{(m5-2)....(25-2)}{(E(s))} = \frac{R(s)}{(+D(s)G(s))}$$

$$\frac{(-4-2)....(29-2)}{(-4-2)(1+L(s))} = \frac{R(s)}{(+D(s)G(s))}$$

zelof From Linal value theorem:

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$$\gamma(t) = \frac{t}{2} \cdot u_s(t)$$
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and analyze the steady state error en the closed-loop system output.

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Type-0 system bus notsys 0-294T L(s)=(x-21)(s-22)...(s-2m) (s-Pi) (s-P2)... (s-Pn) When reservence input is step signal, $R(s) = \frac{1}{s}$ y (+) = (4) $\frac{F_{-}(s)}{F_{-}(s)} = \frac{(s-p_{1}) \cdot (s-p_{2}) \cdot ...}{(s-p_{1}) \cdot (s-p_{2}) \cdot ...}$... (4-5) (19-5) Steady State | error \$. (\$...(9-2) (9-2) lim s.E(s) = lim 1+K (5-21) (5-22).. (s-P1) (s-PL)... (H) wit = (+) = nance hotitudities position R(1)= = 13 Constant

ess = 60.

Type-O system and Ramp signal input (m5-2) (s)= 2)(15-2) 7(4) = t. us(4) (g-2) (g-2) (g-2) /2 | ||x|| = ||Steady state Error S = lim S. E(s) = (im 15.7)... rorra limenta mi) = (2)3.2 mi) (s-P₁) (s-P₂)... $=\frac{1}{2}$ (5-6) (2-6-) Similar situation when rut) = to uslt) $R(1) = \frac{1}{2}$ Constant

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Type-1 system

$$K(s-2i)(s-2z)...(s-2m)$$
 $S(s-pi)(s-pi)...(s-pn)$

when reference input
$$r(t) = U_s(t)$$

 $R(s) = \frac{1}{s}$

$$E(s) = \frac{1}{s}$$

$$t + \frac{(s-2i)(s-2i)\cdots}{s(s-p_2)\cdots}$$

5 (2 - (1) - 11

$$= \lim_{S \to 0} \frac{1 + K(s-t_1)(s-t_2)...}{5(s-p_1)(s-p_2)...}$$

$$= \frac{1}{1+\infty} = \frac{0}{=}.$$

Type-1 or higher type system sholud be Preferred to get Zero Steady State error for refl step input. When Reference Input is ramp signal. $\gamma(t) = t \cdot u_s(t) \qquad R(s) = \frac{1}{s^2}$ (a) = 15 - 1 - 1 (a) 2 (a) (a) = 2 (a) E(s)= $s (s-2i) \cdot \cdot \cdot$ $s (s-9i) (s-92) \cdot \cdot \cdot$ State Error Steady \$. 1/5 ess = lim s. E(s) = lim 5-10 1+ K (5-Z1).. 5 (5-91) ... = 1 m = (2) 3 s + on; | (5-21) ... 8 (S-P1) (S-P2)-.. ··· (23-2) (17-2) 4 / ··· OF Velocity Error Constant. 0 = ...

appressing constants and the processing standard as 1-early the standard as 1-early the triangle of the standard as 1-early the triangle of triangle of the triangle of triangle of triangle of triangle of tr