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Question: Problem 2 (25 marks): For the system of Figure 2, apply the Rout...

Problem 2 (25 marks): For the system of Figure 2, apply the Routh-Hurwitz Criterion to tell how many closed-loop poles are located in the right half-plane, in the left half-plane, and on the $j\omega$ -axis. Notice that here is positive feedback.

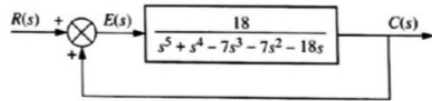


Figure 2

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Expert Answer



Mustak answered this
260 answers

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1
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Given feedback is positive, hence closed loop transfer function is:

$$\frac{G(s)}{1 - G(s)H(s)}$$

we need $1 - G(s)H(s) = 0$ which is characteristic equation

$$1 - \frac{18}{s^5 + s^4 - 7s^3 - 7s^2 - 18s} = 0$$

$$s^5 + s^4 - 7s^3 - 7s^2 - 18s - 18 = 0$$

By Routh Hurwitz criterion.

s^5	1	-7	-18
s^4	1	-7	-18
s^3	$\frac{-7+7}{1}$	$\frac{-18+18}{1}$	0
s^2	0	0	0

→ this indicates system is either marginal stable or unstable.

Auxiliary equation is $s^4 - 7s^2 - 18 = 0$.

differentiate Auxiliary eq $4s^3 - 14s = 0$.

Replace this coefficients in s^3 row.

s^5	1	-7	-18
s^4	1	-7	-18
s^3	0	0	0

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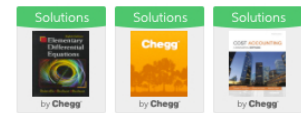
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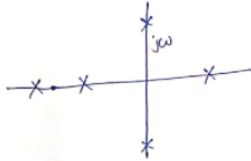
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s^4	4	-14	0
s^3	2	-7	0
s^2	$\frac{-14+7}{2}$	-18	0
s^1	$\frac{111}{-7}$	0	0
s^0	-18		

No. of sign changes = 1 \therefore 1 root on right half of s plane.

Auxiliary eq. = $s^4 - 7s^2 - 18 = 0 \rightarrow$ These roots are symmetric with respect to origin.



No of poles located in right half plane = 1
 " left half plane = 2
 " jw axis = 2

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Q: 4. Using the Routh-Hurwitz criterion, tell how many closed-loop poles of the system shown in Figure 3 lie in the right half-plane and whether the system is stable or not $C(s) = 450s^4 + 3s^3 + 10s^2 + 30s + 150$ Figure 3 A closed-loop control system

A: See answer

Q: Problem 3 (25 marks): For the system of Figure 3, apply the Routh-Hurwitz Criterion to tell how many closed-loop poles are located in the right half-plane, in the left half-plane, and on the jw-axis. Notice that here is positive feedback. $R(s) + C(s) = 18s^3 + 54s^2 - 75s - 185$ Figure 3

A: See answer

Up next for you in Electrical Engineering

| Find the output response, $c(t)$, for each of the systems shown in Figure 3.1. Also find the time constant, rise time,...

Find the output response, the time constant,

See answer

2) For each of the transfer functions shown below, find the locations of the poles and zeros, plot them on the s plane.

d. $T(s) = \frac{20}{s^2 + 6s + 144}$

e. $T(s) = \frac{s+2}{s^2+9}$

f. $T(s) = \frac{1}{s+5}$

See answer

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Q: Problem 3 (25 marks): Given the unity feedback control systems of Figure 3 where $G(s) = \frac{K}{s(s+1)}$ and $a = 1$ to yield a 2% error in the steady state and a 20% overshoot. ce $G(s)$ Figure 3

A: See answer

Q: Problem 3 (25 marks): For the system of Figure 3, apply the Routh-Hurwitz Criterion to tell how many closed-loop poles are located in the right half-plane, in the left half-plane, and on the jw-axis. Notice that here is positive feedback. $R(s) + C(s) = 18s^3 + 54s^2 - 75s - 185$ Figure 3

A: See answer

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