EMEROLE CHINAEME IKENNA
17/ENG05/012
MECHATRONICS ENGINEERING

Question 1

Root Locus is a graphical presentation of the closed loop poles as a system parameter is varied. The root locus also gives a graphical presentation of a system's stability, Before presenting root locus

The Root Locus Technique can be used to analyze & design the effect of a loop gain upon system's transient response & stability. The closed loop transfer function for system with a gain, K, is

$$T(s) = \frac{KG(s)}{1 + KG(s)H(s)}$$

From this equation, a pole, s, exists when the characteristics polynomial in the denominator becomes zero, or

$KG(s)H(s) = -1 = 1\angle(2K+1)180°$ $K = 0, \pm 1, \pm 2, \pm 3, ---$

When -1 represented in polar form as $1\angle(2K+1)180°$
, Alternatively, a value of s is a closed loop pole if
$|KG(s)H(s)| = 1$ and $\angle KG(s)H(s) = (2K+1)180°$

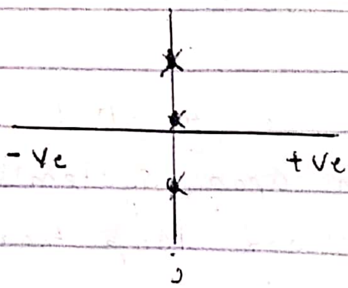
Scanned with CamScanner

Question 2

The use of Routh Hurwitz to find stability of a closed loop system when

Entire row is zero on the Routh table to determine poles of the jω axis

ANSWER



This is the indication of roots on the imaginery axis
This means or makes the system limitedly stable or marginally stable

With the use of an Example:
Consider the Characteristics Equation below

$$s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0$$

s^6	1	8	20	16	1st Row
s^5	$\cancel{2}/2 = 1$	$12/2 = 6$	$16/2 = 8$		
s^4	$2/2 = 1$	$12/2 = 6$	$16/2 = 8$		$[(1\times8) - 6] \div 1$
s^3	0	0	0 ←		Note that an Entire Row of zero's is presents

Scanned with CamScanner

Therefore

Application of Auxillary Equation

$S^4 =$ exenl

Therefore: $S^4 + 6S^2 + 8S^0 = 0$

To get S^3

$\frac{dA}{dS} = \frac{d}{dS}\left[S^4 + 6S^2 + 8\right]$

$S^3 = 4S^3 + 12S' + 0$

$S^3 = 4S^3 + 12S$

S^6	1	8	20	16
S^5	1	6	8	
S^4	1	6	8	
S^3	$4/4 = 1$	$12/4 = 3$		
S^2	3	8		
S^1	0.33	0		
S^0	8			

No sign changes which No positive poles

Due to the Entire row of zeros means there are roots lying on the jw axis.

This means that the system is marginally stable or has limited stablitity.