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EEE 491

(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 representation of a system stability. before presenting root locus.

The root locus technique can be used to analyse and design the effect of a loop gain upon systemic transient response and 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 exist when the characteristic polynomial in the denominator becomes zero or

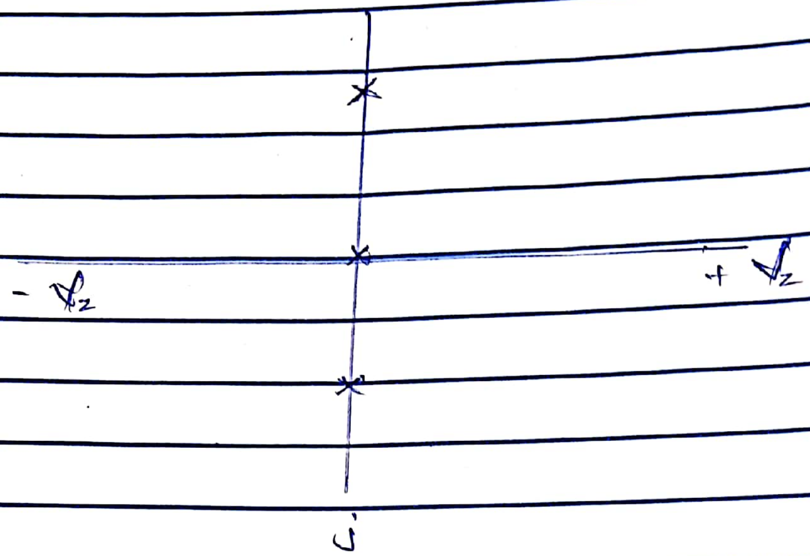
$$KG(s)H(s) = -1 = K(2k+1)180^\circ$$

where $k = 0, \pm 1, \pm 2, \pm 3, \pm 4 \ldots$

When -1 represented in polar form as $K(2k+1)180^\circ$ Alternatively a value of s is a closed loop pole of $|KG(s)H(s)|$ and

$$\angle KG(s)H(s) = (2k+1)180^\circ$$

(2) The use of Routh Hurwitz to find stability of a closed loop system when entire row is zero on the routh hurwitz table to determine poles of the $j\omega$ axis.



This is the indication of roots on the imaginary axis.

This means or makes the system limitedly stable or marginally stable.

With the use of an example:
Consider the characteristic equation below

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

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

Therefore
Application of Auxiliary Equation

S^4 = even 1
Therefore = $s^4 + 6s^2 + 8s = 0$

To get S^3

$$\frac{dA}{ds} = \frac{d}{ds} \cdot \left[s^4 + 6s^2 + 8\right]$$

$$S^3 = 4s^3 + 12s^1 + 0$$
$$S^3 = 4s^3 + 12s$$

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 means no Positive Poles

Due to the entire row of Zeros means there are roots lying on the jω axis

This means that the system is marginaly stable or has limited stability.