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17/Eng04/1029

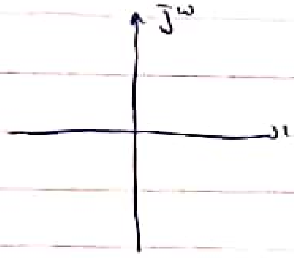
EEE401

Elect/Elect

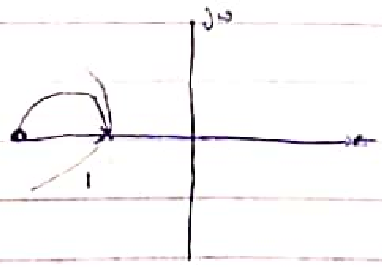
1) Root Locus is a graphical presentation of the closed loop poles as a system parameter is varied. The root locus gives a graphic presentation of a system's stability.

Rules of Root locus is always symmetrical about the real axis

Eg



2) The root locus always starts from the open-loop poles and terminates on either finite open loop zero and infinity

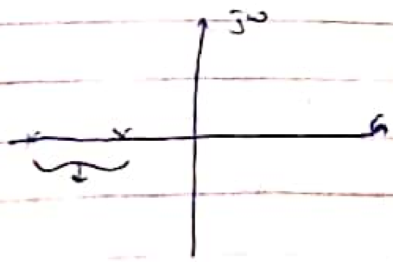


3) The number of branches terminates on infinite = P-Z

where P = number of poles

Z = number of zero's

4) A point on the real axis lies on the locus if the number of open loop poles + zero's on the right half of s plane is odd



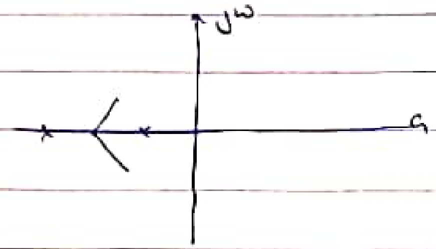
5) The angle of asymptotes

if $P > Z$ $\quad \phi_A = \dfrac{(2q+1)180^\circ}{P-Z}$ $\quad q = 0, 1, 2, \dots, P-Z-1$

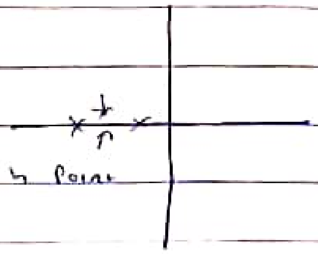
If $Z > P$ $\quad \phi_A = \dfrac{(2q+1)}{Z-P} 180$ $\quad q = 0, 1, 2, \dots, Z-P-1$

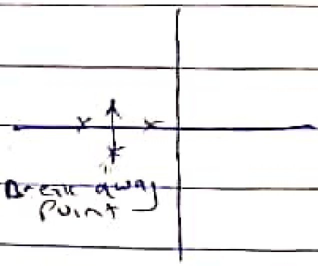
6) Centroid: The asymptotes meet the Real Axis at Centroid.

$$\text{Centroid} = \frac{\text{Sum of Real Parts of Poles} - \text{Sum of Real Parts of Zeros}}{\text{number of Poles} - \text{No of zero's}}$$



7) Break away & Break in Point is calculated by solving $\frac{dk}{ds} = 0$





When two poles are Present = Break away while when two zero's are present Break in

8) The angle of departure from an open-loop to Poles is given by

$\phi_P = \pm 180^\circ (2q+1) + \phi$ $\quad q = 0, 1, 2 \dots$

when you have Imaginary Poles.

Where $\phi = \theta_2 - (\theta_1 + \theta_3 + \theta_4)$

9) The angle of arrival from an open loop zero is given by

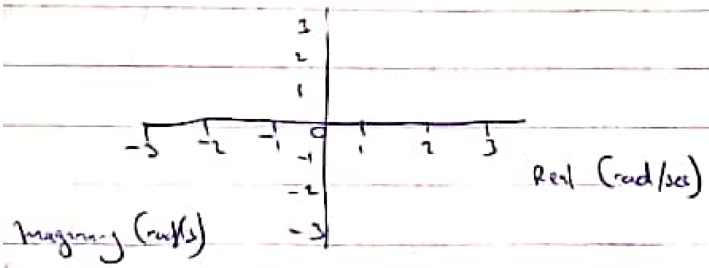
$\phi_z = \pm 180^\circ (2q+1) - \phi$; $\quad q = 0, 1, 2, 3$

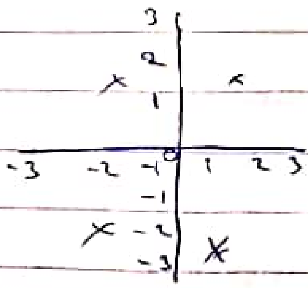
when you have Imaginary zeros

10) The Intersection of root locus branches the Imginary axis Can be determined by use of routh Criteria

the Intersection Point of the root locus on the Real axis is Called CENTROID but the Intersection Point of the root locus on the Imaginary axis is Called the Intersection Point.

2) A whole row of zero's Indicate the Presence of Pairs of Poles that are mirrored about the imaginary axis





→ At best the system is marginary stable
→ Use a Routh table to determine if it is ustable
→ If an entire row of zero's appears in a Routh table.

i) Create the an auxillary Polynomial from the row above the row of zero, Skipping other Power of s.

ii) Differentiate the auxiliary Polynomial w.r.t s

iii) Replace the zero row with the co-efficients of the resulting Polynomial

iv) Complete the Routh table as usual.

v) Evaluate the sign of the first Column entries.

b) To determine the poles on the jω axis

Determined the system poles for the under damped system the poles are

$= -\sigma \pm j\omega$