EE 371 Classical Control

Rules For Sketching Root Loci

1- The number of root locus branches is equal to the number of open-loop poles of \( L(s) \).

2- Root locus branches start at the open-loop poles and end at the open-loop zeros or at infinity.

3- Real axis root loci have an odd number of poles plus zeros to their right.

4- The branches going to infinity asymptotically approach the straight lines defined by the angle

\[
\theta_a = \frac{\pm (2m + 1)180^\circ}{n_p - n_z}, \quad m = 0, 1, 2, \ldots
\]

and the intercept

\[
\sigma_a = \frac{\sum p_i - \sum z_j}{n_p - n_z}
\]

5- Breakaway points (points of departure from the real axis) correspond to maxima of \( K \), while break-in points (points of arrival at the real axis) correspond to minima of \( K \).

6- The angle of departure from a complex pole \( p_n \) is given by

\[
\theta_{p_n} = \mp 180^\circ + \angle G_{p_n}(p_n)
\]

\[
G_{p_n}(s) = G(s)(s - p_n)
\]

The angle of arrival at a complex zero \( z_m \) is

\[
\theta_{z_m} = \pm 180^\circ - \angle G_{z_m}(z_m)
\]

\[
G_{z_m}(s) = G(s)/(s - z_m)
\]