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Basic Control

Rules for the Construction of the Root Locus

1. The n branches of the root locus begin for $K_R = 0$ in the n poles of the open loop.

   They end for $K_R \to \infty$:

   (a) m branches end in the m zeros of the open loop
   (b) $n - m$ branches end in infinity.

2. The root locus is symmetrical to the real axis.

3. A point on the real axis belongs to the root locus, if on its right side on the real axis an odd number of crucial points of the open loop are located.
   Such crucial points are poles and zeros.

4. The asymptotes of the root locus branches moving to infinity meet themselves in the root focal point, which is located on the real axis. Its postition is

   $$\delta = \frac{\sum^{n} \text{Re } s_{\text{pole}} - \sum^{m} \text{Re } s_{\text{zero}}}{n - m}.$$

   The inclinations of the asymptotes of the root locus are

   $$\varphi_i = (2i + 1)\frac{\pi}{n - m} \quad \text{with} \quad i = 0, 1, \ldots n - m - 1.$$

5. One receives the branching points, which are different from the crucial points of the root locus, from

   $$\sum^{m} \frac{1}{s - s_{\text{zero}}} - \sum^{n} \frac{1}{s - s_{\text{pole}}} = 0$$

6. If in a branching point of the root locus, on which no crucial point is located, meet r branches (with 2 r curve pieces), then the value of the cutting angle of neighbouring curve pieces is

   $$\Delta\, \psi = \frac{\pi}{r}.$$