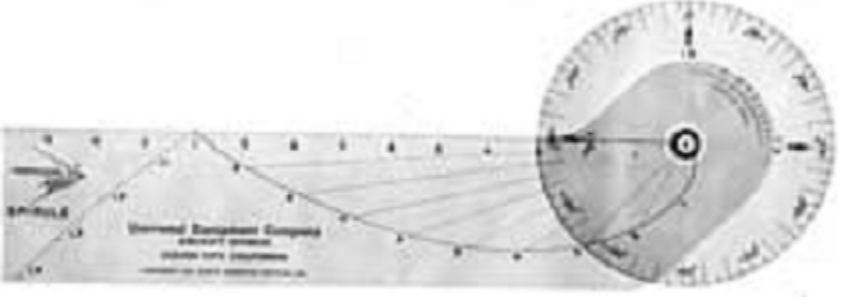
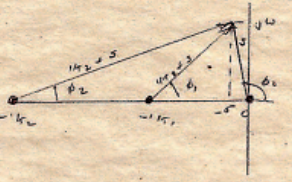


THE ROOT LOCUS PLOT

Find values of s which make $\frac{K}{(1+T_1 s)(1+T_2 s)s} = -1$

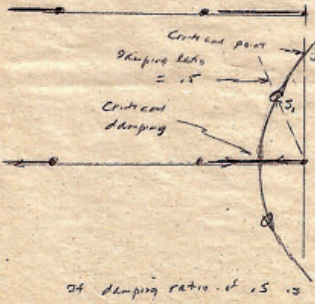
Treating a term $\frac{1}{1+T_1 s}$ as a vector having a phase angle and magnitude, we can first concentrate on making the sum of the angles = 180°. The magnitude ratio being unity depends on gain K and can be satisfied later.

Plot the $-1/T_1$ and $-1/T_2$ as before for convenience in letting s vary.



The locus of roots is the path of s for which $\phi_0 + \phi_1 + \phi_2 = 180°$

The process is trial and error. — The trick is to make the easy trials first!



Real axis, $\phi_0 = 180°$, $\phi_1 = \phi_2 = 0$
or $\phi_0 = \phi_1 = \phi_2 = 180°$

Proceed till whole locus is sketched.

Note roots would have to be very near a dot for K very small.

As K increases, roots move out as shown by arrows

If damping ratio of .5 is desired estimate

$\frac{1/T_1}{|1+s|}$ $\frac{1/T_2}{|1+s|}$ $\frac{1}{|s|}$ and make K equal to the s so that

$\left|\frac{\theta_0}{\theta_1}(s)\right| = 1$