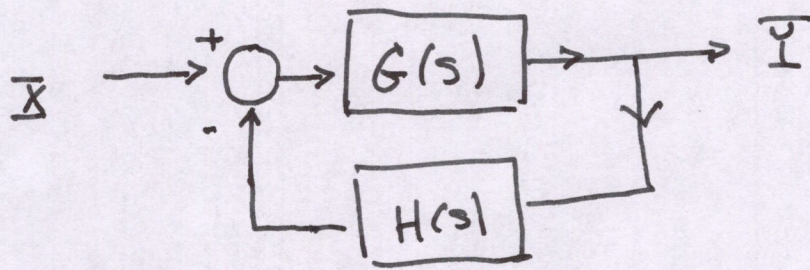


Root Locus



$$\bar{Y} = \frac{G(s)}{1 + GH}$$

Characteristic eqn.

$$1 + GH = 0$$

$$GH = -1$$

$$\Rightarrow |GH| = | \underline{\text{Mag Cond}} |$$

$$\angle GH = (2n+1)\pi$$

Angle cond

Two week
test II

Stability
↓
root locus

Form-factor of GH

$$GH = \frac{K N(s)}{D(s)}$$

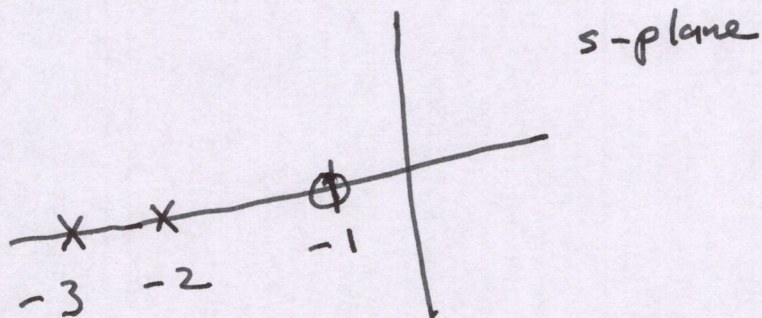
zeros: $N(s) = 0$

poles: $D(s) = 0$

gain: $K > 0$

example

$$GH = \frac{K(s+1)}{(s+2)(s+3)}$$

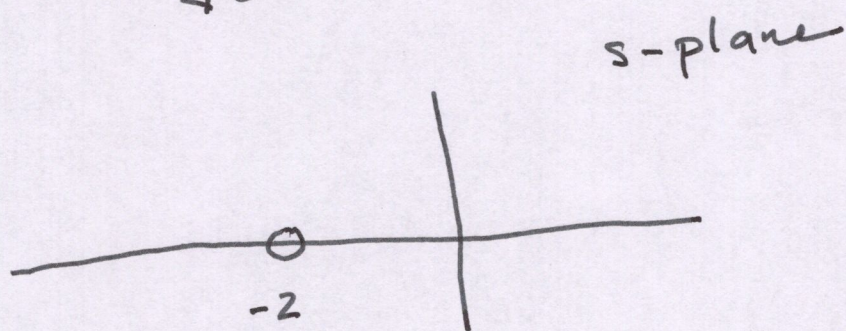


Objective: track the migration
of the closed-loop pole as
a function of K

step one: real line root locus

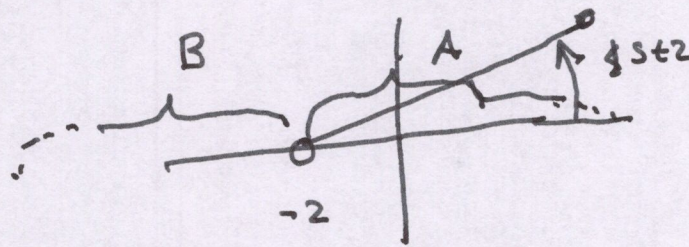
real-line root locus satisfy
the angle condition

$$\angle GH = (2n+1)\pi \quad \text{for } n=0, 1, 2, \dots$$



$$GH = K(s+2)$$

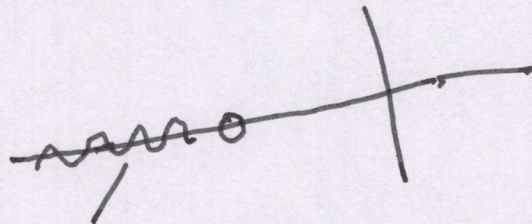
s-plane



$$GH = k(s+2)$$

$$k > 0$$

region	$\angle k$	$\angle s+2$	$\angle GH = \angle k + \angle (s+2)$
A	0	0	π
B	0	π	0



root-locus

Direction migration

$$1 + GH = 0$$

$$1 + k \frac{N(s)}{D(s)} = 0$$

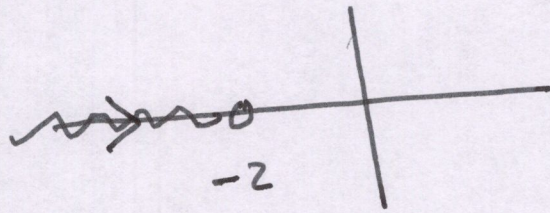
$$D(s) + kN(s) = 0$$

$$\left. \begin{array}{l} k \rightarrow 0 \\ D(s) = 0 \end{array} \right\}$$

$$\left. \begin{array}{l} k \rightarrow \infty \\ N(s) = 0 \end{array} \right\}$$

as $k \rightarrow 0$ to ∞

start at poles
end at zeros



example

$$GH = \frac{(s+1)^k}{(s+2)(s+3)}$$

