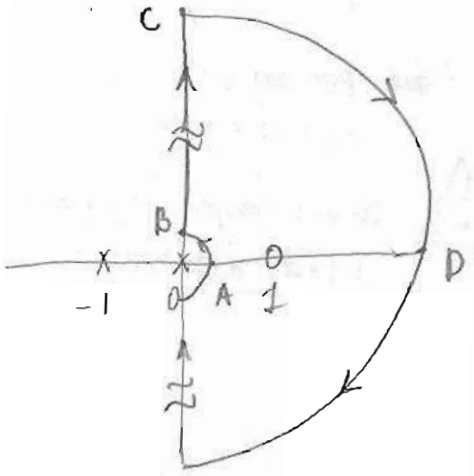
Example: $G(s)H(s) = \dfrac{s-1}{s(s+1)}$ (skipped Spring 2015/16)



$A \to B \quad s = \varepsilon e^{j\theta} \quad \theta: 0 \to \pi/2$

$$GH\Big| = \frac{\varepsilon e^{j\theta} - 1}{\varepsilon e^{j\theta}(\varepsilon e^{j\theta} + 1)} = \frac{-1}{\varepsilon e^{j\theta}} = \frac{1 e^{j\pi}}{\varepsilon e^{j\theta}}$$

$$= R e^{j(\pi - \theta)} \qquad R \to \infty$$

$\phi: \pi \to \pi/2$

$B \to C \quad s = j\omega$

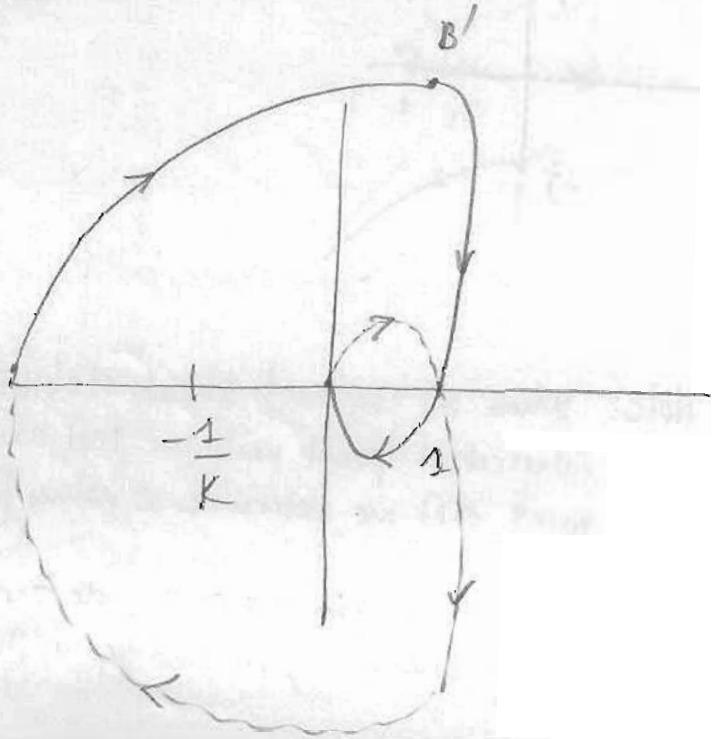
$$GH\Big|_{s=j\omega} = \frac{j\omega - 1}{j\omega(j\omega+1)} = \frac{j\omega - 1}{-\omega^2 + j\omega} = \frac{(-1+j\omega)(-\omega^2 - j\omega)}{\omega^4 + \omega^2}$$

$$= \frac{\omega^2 + j\omega - j\omega^3 + \omega^2}{\omega^2(\omega^2+1)} = \frac{2\omega^2 + j(\omega - \omega^3)}{\omega^2(1+\omega^2)}$$

$$= \frac{2\omega^2}{\omega^2(1+\omega^2)} + j\frac{\omega(1-\omega^2)}{\omega^2(1+\omega^2)}$$

$$= \frac{2}{1+\omega^2} + j\frac{1-\omega^2}{\omega(1+\omega^2)}$$

ω	$\omega \to 0$	$\omega = 1$	$\omega \to \infty$
Re	2	1	0
Im	∞	0	0 (-)ve



$-\infty < -\frac{1}{K} < 0 \to 0 < K < \infty$

$\to N = 1$ 1 unstable pole.

$0 < -\frac{1}{K} < 1 \quad -\frac{1}{K} > 0 \to \boxed{K < 0}$

Two unstable poles. $-\frac{1}{K} < 1 \to \frac{1}{K} > -1$

$\boxed{K < -1}$

Example: $G(s)H(s) = \dfrac{s+1}{s(s+2)}$

Solve example: