LAST HOMEWORK PROBLEM

EXAMPLE W/ NO $j\omega$-AXIS CROSSINGS

7.8d $GH = \dfrac{5k(s+5)}{(s+10)(s^2+10s+25)}$

CE: $1 + GH = 0 \Rightarrow$

$(s+10)(s^2+10s+25) + 5k(s+5) = 0$

$s^3 + 20s^2 + (125+5k)s + (250+25k) = 0$

ROUTH ARRAY

s^3	1	$(125+5k)$
s^2	20	$(250+25k)$
s^1	A	0
s^0	$(250+25k)$	

$A = \dfrac{20(125+5k) - (250+25k)}{20} = \dfrac{2250+75k}{20}$

NO 0's OR SIGN CHANGE FOR ANY $k > 0$ $\Rightarrow$ NO $j\omega$-AXIS CROSSINGS

$s = j\omega \Rightarrow$

$-j\omega^3 - 20\omega^2 + (125+5k)\omega j + (250+25k) = 0$

real: $-20\omega^2 + 250 + 25k = 0$ ①

imag: $-\omega^3 + (125+5k)\omega = 0$ ②

② $\rightarrow -\omega^2 + (125+5k) = 0$

① $\Rightarrow 5k = 4\omega^2 - 50$ ③ → ③ $\Rightarrow$

$-\omega^2 + 4\omega^2 + 75 = 0$

$\Rightarrow 3\omega^2 = -75$

$\omega = \pm 5j$ → ③ $\Rightarrow$ $k = -30 < 0 \Rightarrow$ NO $j\omega$-AXIS CROSSING