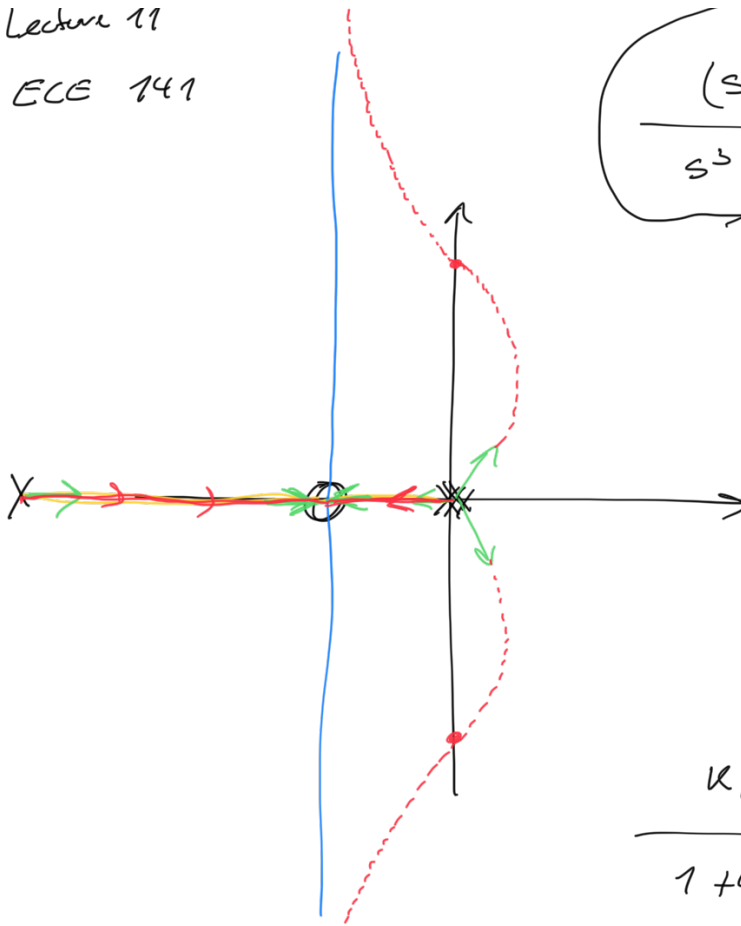


Lecture 11

ECE 141



$$\frac{(s+1)^2}{s^3(s+4)} = L(s)$$

$$1 + K L(s)$$

$$\frac{K L(s)}{1 + K L(s)}$$

$$\frac{L(s)}{1 + K L(s)}$$

$$\frac{K L(s)}{1 + K L(s)} = \frac{K \frac{(s+1)^2}{s^3(s+4)}}{1 + K \frac{(s+1)^2}{s^3(s+4)}}$$

$$= \frac{K (s+1)^2}{s^3(s+4) + K (s+1)^2}$$

$$s^4 + 4s^3 + K(s^2 + 2s + 1)$$

$$\begin{array}{c|ccc} 4 & 1 & K & K \\ 3 & 4 & 2K & \\ 2 & b_1 & K & \\ 1 & c_1 & & \\ 0 & K & & \end{array}$$

$$b_1 = \frac{2K - 4K}{-4} = \frac{-2K}{-4} = \frac{K}{2}$$

$$c_1 = \frac{4K - 2K b_1}{-\frac{K}{2}} = \frac{4K - 2K \frac{K}{2}}{-\frac{K}{2}}$$

$$= -\frac{2}{K} \frac{4K - K^2}{1}$$

$$1 \quad K=0$$

$$4 \quad K=4$$

$$\frac{K}{2}$$

$$2(4-4)$$

K

$$1 + K L(s) = 0$$

$$1 + 4 L(s) = 0$$

$$\boxed{s = j\omega_0}$$

$$1 + 4 L(j\omega_0) = 0$$

$$= - \frac{2(4-4)}{7}$$

$$b \frac{da}{ds} - a \frac{db}{ds} = 0$$

$$(s+1)^2 [3s^2(s+4) + s^5] - s^3(s+4)2(s+1)$$

\vdots

$$(s+1)s^2 [4(s+1)(s+3) - 2(s+4)s]$$

\swarrow $s = -1$ \nearrow $s = 0$

$$s^2 + 4s + 6 = 0$$

$$s = -2 \pm j\sqrt{2}$$

$$s = -1, 0, 0, \underline{-2 \pm j\sqrt{2}}$$

not on the real axis