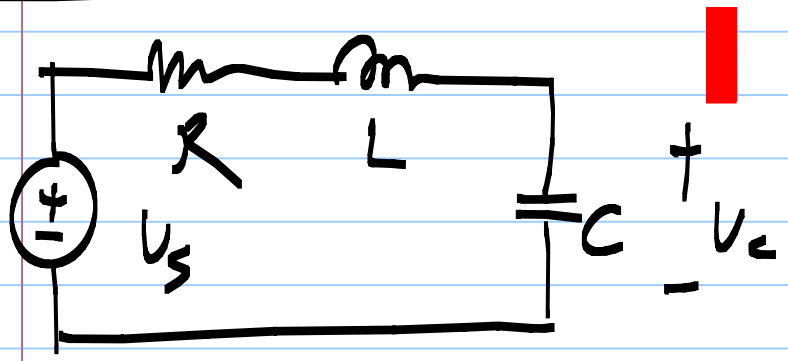
EE 2015

Second order systems

$v_s = V_p \exp(j\omega t)$

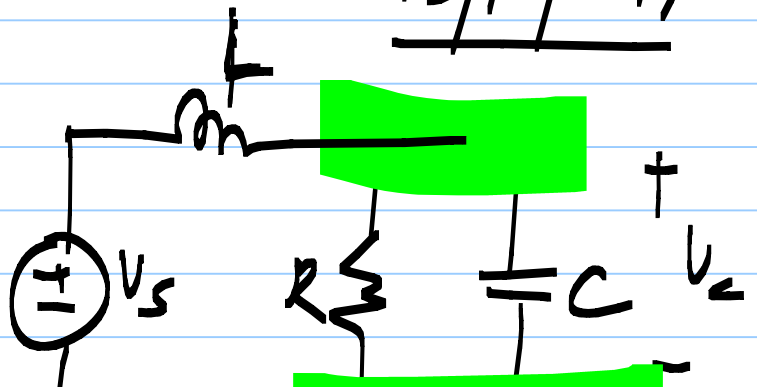
13/10/2017



$$LC\frac{d^2v_c}{dt^2} + \text{[redacted]} + v_c = v_s$$

$$v_c(t) = V_p \cdot \exp(j\omega t) \cdot H(j\omega)$$

(S.S)



$$LC\frac{d^2v_c}{dt^2} + \text{[redacted]}\,\frac{dv_c}{dt} + v_c = v_s$$

$v_c(t) =$

(S.S)

$$V_s = V_p \exp(j\omega t)$$ SERIES RLC

$$V_c = V_p \cdot \exp(j\omega t) \cdot \underbrace{H(j\omega)}$$

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

$$H(j\omega) = \frac{1}{\left(1 - \frac{\omega^2}{\omega_n^2}\right) + j\frac{\omega}{Q\omega_n}}$$

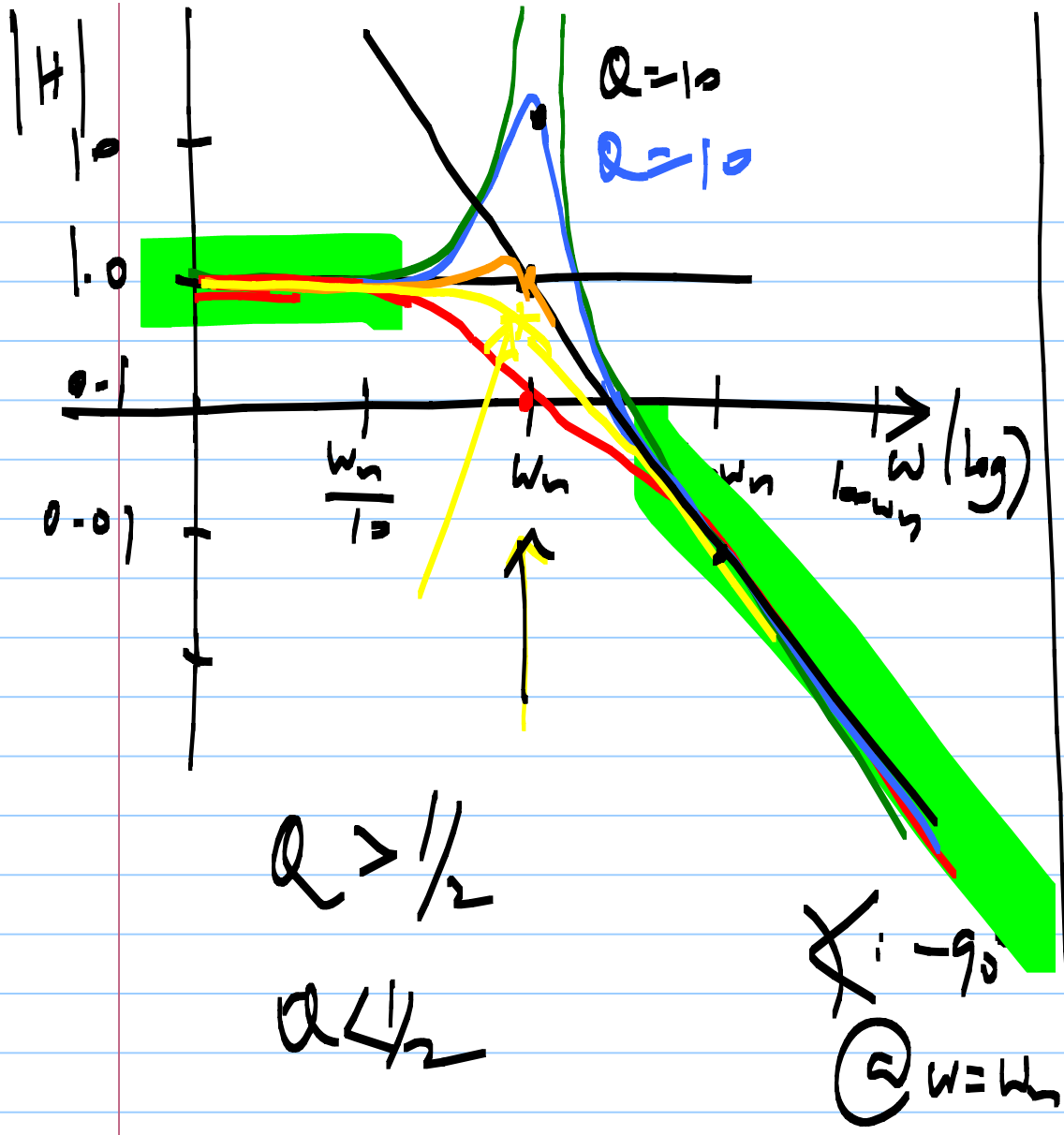
$$j \cdot \frac{2\zeta\omega}{\omega_n}$$

PARALLEL RLC

$$H(j\omega) = \frac{1}{(1 - \omega^2 LC) + j\omega \cdot \frac{L}{R}}$$

Log. $|H(j\omega)|$ $\omega \gg \omega_n$ $\omega \ll \omega_n$

$\not\leftarrow H(j\omega)$



$$H(j\omega) = \frac{1}{\quad + j\frac{\omega}{Q\omega_n}}$$

$$|H(j\omega)| = \frac{}{\sqrt{\left(1-\frac{\omega^2}{\omega_n^2}\right)^2 + \left(\frac{\omega}{Q\omega_n}\right)^2}}$$

$\omega \ll \omega_n$: $|H(j\omega)| \simeq 1$

$\measuredangle H$: $0°$

$\omega \gg \omega_n$:

$\measuredangle H$: $-$

$Q > 1/2$

$Q < 1/2$

$\measuredangle$: $-90°$

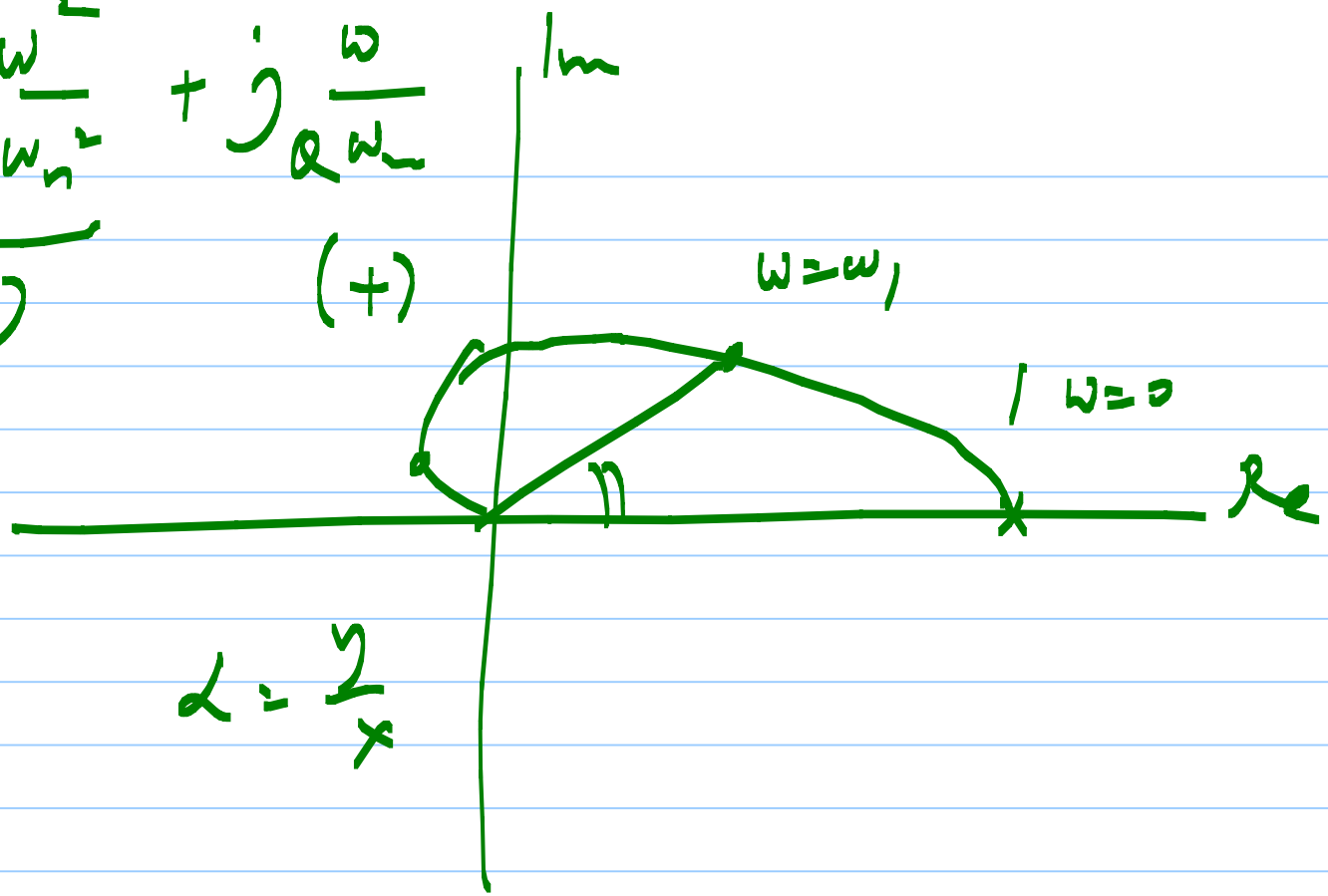
@ $\omega = \omega_n$: $|\cdot| = Q$

$$h(t) \overset{\mathcal{F}}{\longleftrightarrow} H(j\omega)$$

real

$$H(j\omega) = H^*(-j\omega)$$

$$\underbrace{1 - \frac{\omega^2}{\omega_n^2}}_{(-)} + j\frac{\omega}{Q\omega_n} \quad (+)$$



$$-\tan^{-1}(\alpha) \qquad \alpha = \frac{y}{x}$$

$$\tan^{-1}(y, x)$$

$$|H(j\omega)|^2 = \frac{1}{1 + \frac{\omega^2}{\omega_n^2}\left(\frac{1}{Q^2} - 2\right) + \frac{\omega^4}{\omega_n^4}}$$

$\frac{1}{Q^2} - 2 = 0$

$Q = \frac{1}{\sqrt{2}}$

$\frac{\partial |H(j\omega)|^2}{\partial \omega}$

$\omega = 0$

$|H(j\omega)|^2 = \frac{1}{1 + (\omega^2 \quad \omega^4 \quad \omega^{2N}}$

ω (log)