Lecture 9

s-plane

$$s \equiv \sigma + j\omega$$

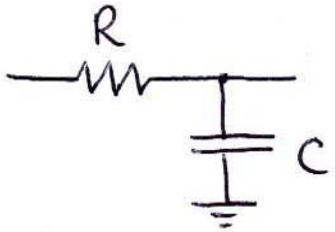
$$v(t) = V_0 e^{st} \; ; \quad \begin{cases} Re\{s\} < 0 \\ Re\{s\} > 0 \end{cases}$$

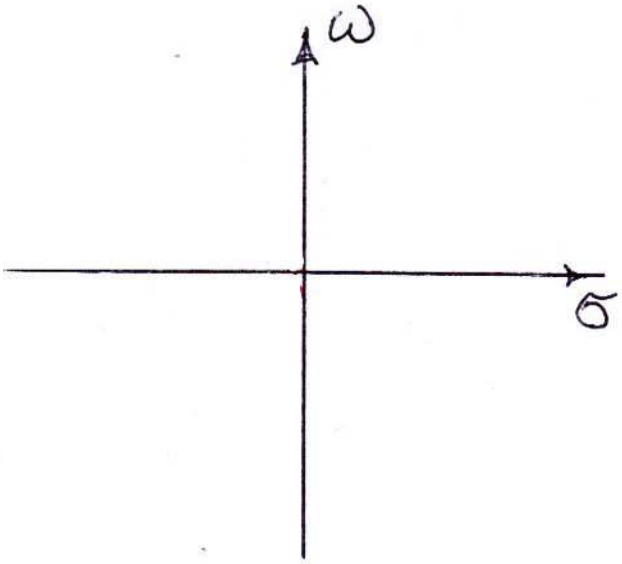
if $s = j\omega \Rightarrow$

Impedence in s-domain: $Z_C = \frac{1}{sC}$, $Z_L = sL$

$$G(s) = \frac{V_{out}(s)}{V_{in}(s)}$$ - gain (transfer fcn) in s-plane

Ex.





$G(\omega)$:

$G(s)$:

Zero-pole form of transfer fcn

Most natural when using s-plane

$$G(s) = \frac{N(s)}{D(s)} =$$

$\Rightarrow G(s)$ @

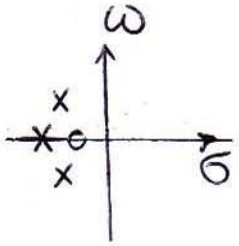
—

Some properties

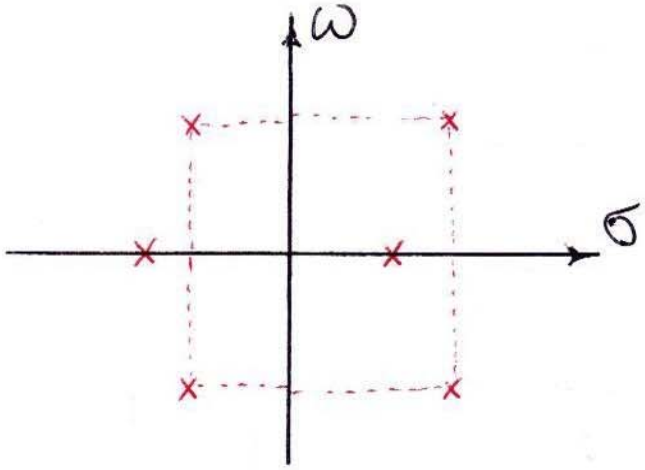
1)

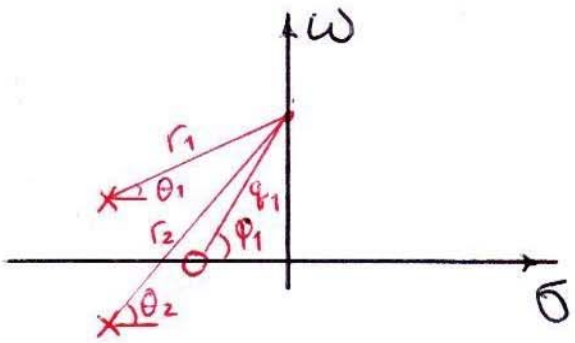
2)

3)



4)



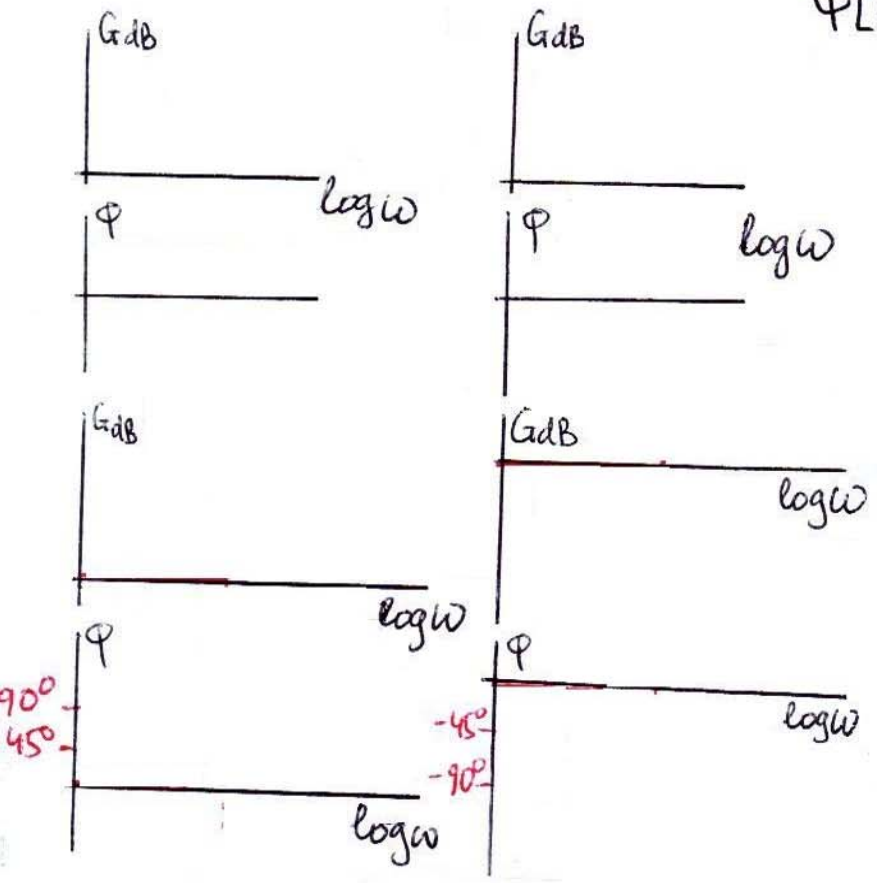


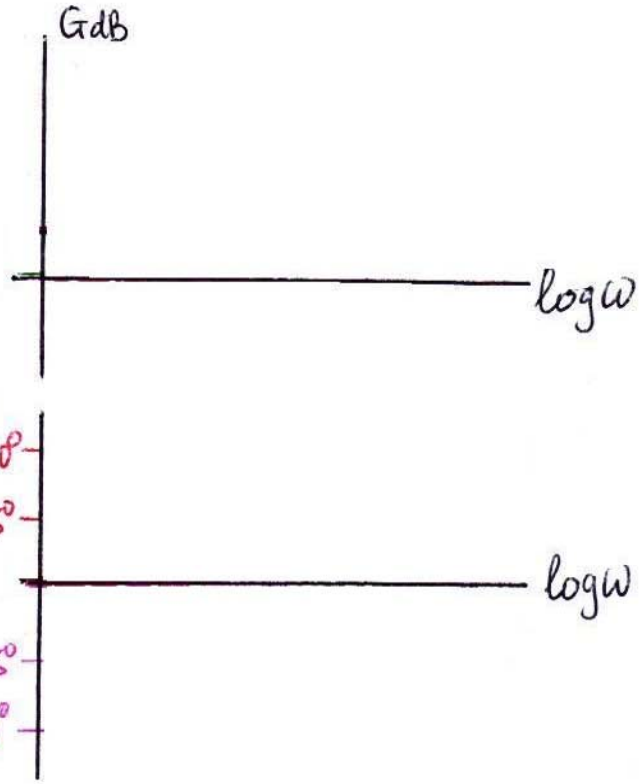
Bode Plots:

$|G(\omega)| =$

$\Phi[G(\omega)] =$

⇒ on Bode plots:

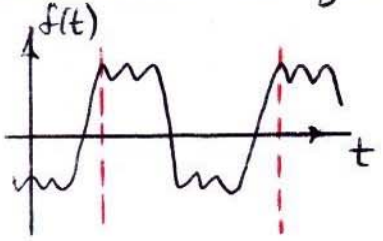




Ex. $G = K \dfrac{1 + j\omega/\omega_z}{1 + j\omega/\omega_p}$ ⇒

let $\omega_z \ll \omega_p$

Fourier Analysis



Basic idea:

$$f(t) = \sum_{n=-\infty}^{\infty} c_n e^{jn\omega t}$$

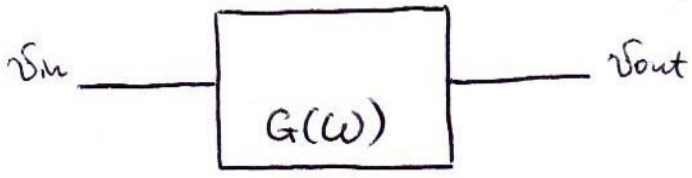
Definition: $g(t)$ and $h(t)$ orthogonal if

$\{e^{jn\omega t}\}$ forms orthogonal set:

$$f(t) = \sum_{n=-\infty}^{\infty} c_n \quad e^{jn\omega t}$$

Strategy

1) source decomp. (superp.)

2) find response @ each harmonic $n\omega$

3) find v_{out}