

KEY

QUIZ # 2

ECEN 380; Signals and Systems

Fall 2013

Closed book, closed notes, closed neighbor, no calculators needed or allowed. Time limit is 10 minutes. 20 points total possible.

You have been given an LTI system described by the following LCCDE.

$$\frac{d^2 y(t)}{dt^2} + A \frac{dy(t)}{dt} + B y(t) = C \frac{dx(t)}{dt} + D x(t), \text{ with } x(t) = \cos \omega t.$$

- A. Find an expression for ω so that $y(t) = |H(\omega)| \cos \omega t$.
- B. Is there any constraint on A, B, C and D. If yes, what is the constraint.

A. $[-\omega^2 + A j\omega + B] H(\omega) = C j\omega + D$

$$H(\omega) = \frac{D + j\omega C}{B - \omega^2 + jA\omega}$$

we want $\angle H(\omega) = 0 = \tan^{-1} \frac{\omega C}{D} - \tan^{-1} \frac{A\omega}{B - \omega^2}$

\therefore we want $\frac{\omega C}{D} = \frac{A\omega}{B - \omega^2}$

$$BC\omega - C\omega^3 = AD\omega$$

$$BC - AD = \omega^2$$

$$\omega = \pm \sqrt{BC - AD}$$

$$\omega = \pm \sqrt{BC - \frac{AD}{C}}$$

B) ω must be real

\therefore $B > \frac{AD}{C}$