Olin College of Engineering
ENGR2410 – Signals and Systems

Quiz 2

Instructions

A. Collaboration is not allowed on quizzes.

B. Students may only use a page of notes and the tables from the website during the quizzes.

C. Time is limited to one continuous hour.

D. Quizzes are due at the beginning of lecture on Thursday.

E. Late or missed quizzes will be given a score of zero. Any excuses must come directly from the Office of Student Life.

F. The two lowest quiz scores will be eliminated to allow for unforeseeable circumstances.

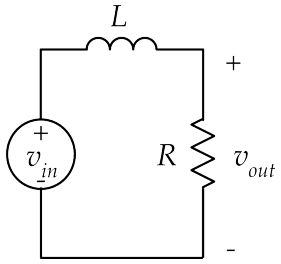
G. In case of doubt, students are expected to base their behavior on the values expressed in the Honor Code.

Name:

Start time:

Problem 1 *(10 points)*

A. Find v_{out} in the circuit below if $v_{in} = V\cos\omega t$. You may assume all transients have disappeared.



Solution:

$$\dot{v}_{out} + \frac{1}{L/R}v_{out} = \frac{1}{L/R}v_{in}$$

$$v_{in} = e^{j\omega t} \qquad v_{out} = H(j\omega)e^{j\omega t}$$

$$H(j\omega)j\omega e^{j\omega t} + \frac{1}{L/R}H(j\omega) = \frac{1}{L/R}e^{j\omega t}$$

$$H(j\omega) = \frac{\frac{1}{L/R}}{j\omega + \frac{1}{L/R}} \qquad |H(j\omega)| = \frac{\frac{1}{L/R}}{\sqrt{\omega^2 + \frac{1}{(L/R)^2}}} \qquad \angle H(j\omega) = -\tan^{-1}\omega L/R$$

$$\boxed{v_{out} = V\frac{\frac{1}{L/R}}{\sqrt{\omega^2 + \frac{1}{(L/R)^2}}}\cos\left(\omega t - \tan^{-1}\omega L/R\right)}$$

B. Sketch the Bode plot of the circuit using asymptotic approximations.

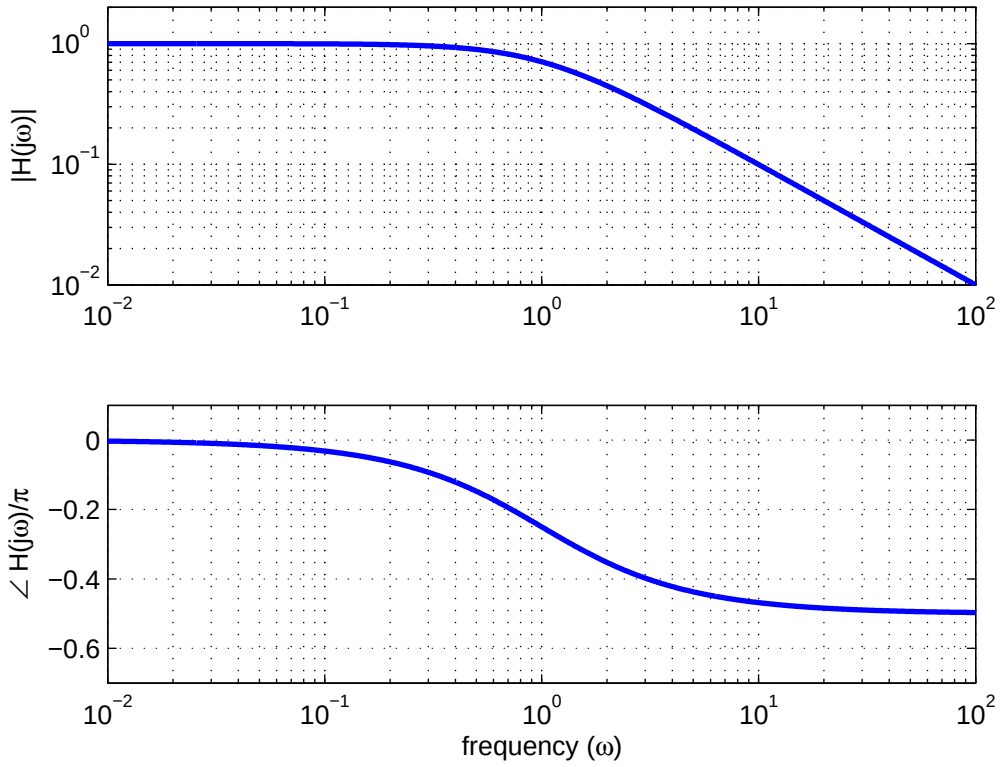
Solution:

$$H(j\omega) = \frac{\frac{1}{L/R}}{j\omega + \frac{1}{L/R}}$$

If $\omega \to 0$, then $H(j\omega) \approx \dfrac{\frac{1}{L/R}}{\frac{1}{L/R}} = 1$ and $|H(j\omega)| = 1$, $\angle H(j\omega) = 0$

If $\omega \to \infty$, then $H(j\omega) \approx \dfrac{\frac{1}{L/R}}{j\omega}$ and $|H(j\omega)| = \dfrac{1}{\omega L/R}$, $\angle H(j\omega) = -\dfrac{\pi}{2}$

Intersection at $\omega = \frac{1}{L/R}$. Since this system is first order, the Bode plot transitions smoothly at the intersection.



Course feedback
Feel free to send any additional feedback directly to us.

Name (optional):

A. End time: How long did the quiz take you?

B. Was the quiz a fair measure of your understanding?

C. Was the assignment effective preparation for the quiz?

D. Is the Monday session effective?

E. Are the connections between lecture, assignment and quiz clear?

F. Are the objectives of the course clear? Do you feel you are making progress towards those objectives?

G. Anything else?

Assignment grades

Date:

Assignment number:

Group member 1:

Grade:

Group member 2:

Grade:

Group member 3:

Grade: