

EE4445 Quiz 2

March 6, 2009

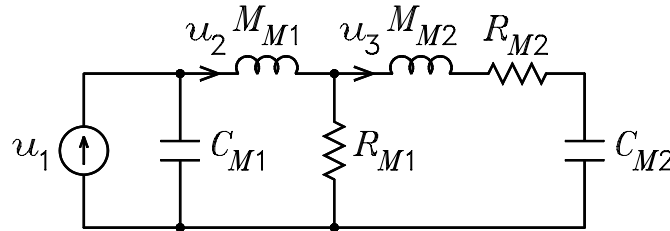
Professor Leach

Name _____

Instructions. Print your name in the space above and at the top of all other pages in your quiz. Express all answers as a decimal number, i.e. do not give an answer that involves fractions, square roots, symbols such as π , etc. Draw a box around answers. Draw a horizontal line between problems.

Honor Code: *I have neither given nor received help on this quiz.* Initials _____

1. The figure shows an impedance analogous circuit for a mechanical system. Solve for and label
 - (a) the mobility analog
 - (b) the mechanical diagram
 - (c) the mechanical system.



2.
 - (a) Describe the proximity effect.
 - (b) What microphone type (or types) are affected by the proximity effect?
 - (c) Calculate the frequency at which the proximity effect causes the output of a microphone to be boosted by 8 dB compared to higher frequencies for a talker who is 1.5 ft from the microphone.
3. A loudspeaker driver has the parameters $R_E = 6.4 \Omega$, $f_S = 28 \text{ Hz}$, $Q_{MS} = 3.24$, $Q_{ES} = 0.383$, and $V_{AS} = 12.5 \text{ ft}^3$.
 - (a) What value of resistor must be added in series with the voice coil to obtain a Butterworth alignment?
 - (b) What is the new -3 dB cutoff frequency?
 - (c) By how many dBs does the on-axis pressure at midband drop when the resistor is added?
4. In modeling the low-frequency response of a driver in an infinite baffle, what acoustical variable is described by a:
 - (a) 2nd order low-pass transfer function?
 - (b) 2nd order band-pass transfer function?
 - (c) 2nd order high-pass transfer function?
5.
 - (a) What are the two basic parameters required to sketch the Bode plot for the low-frequency on-axis pressure response of a driver in an infinite baffle?
 - (b) Show how the parameters are used to sketch a typical Bode plot for the low-frequency on-axis pressure.

Problem 2

$$H_{\text{prox}}(s) := 1 + \frac{c}{s \cdot r} \quad 8 = 20 \cdot \log \left[\sqrt{1 + \left(\frac{345}{2 \cdot \pi \cdot f \cdot 1.5 \cdot \frac{12}{39.37}} \right)^2} \right] \quad f := 52.1197495475396964$$

Problem 3

$$R_E := 6.4 \quad f_S := 28 \quad Q_{MS} := 3.24 \quad Q_{ES} := 0.383 \quad V_{AS} := 12.5 \cdot \left(\frac{12}{39.37} \right)^3$$

Part (a)

$$\frac{Q'_{ES} \cdot 3.24}{Q'_{ES} + 3.24} = \frac{1}{\sqrt{2}} \quad Q'_{ES} := .90450949689764556415$$

$$\left(1 + \frac{R_g}{6.4} \right) \cdot 0.383 = .90450949689764556415 \quad R_g := 8.7145190082113096881$$

Part (b)

$$f_{3\text{dB}} := f_S \quad f_{3\text{dB}} = 28$$

Part (c)

$$\text{dB} := 20 \cdot \log \left(\frac{R_E}{R_g + R_E} \right) \quad \text{dB} = -7.464$$