

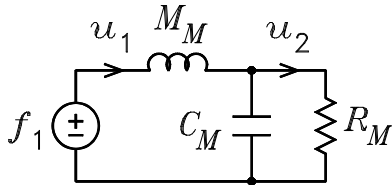
## EE4445 Quiz 2

March 7, 2007

Professor Leach      First Name: \_\_\_\_\_ Last Name: \_\_\_\_\_

**Instructions.** *Print* your name in the spaces above and at the top of all other pages in your quiz. Draw a box around answers. Express all answers as a decimal number. Draw a horizontal line between problems.

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



2. A loudspeaker driver has the measured parameters  $R_E = 6.4 \Omega$ ,  $f_S = 30 \text{ Hz}$ ,  $Q_{ES} = 0.55$ ,  $Q_{MS} = 5.4$ , and  $V_{AS} = 6.2 \text{ ft}^3$ .
  - (a) Calculate the new  $f_S$  and  $Q_{TS}$  if a  $3 \Omega$  resistor is added in series with the voice-coil.

$$f_S = 30 \text{ Hz} \quad Q_{TS} = 0.703$$

- (b) Calculate the new  $f_S$  and  $Q_{TS}$  if the magnet weight of the original driver is increased by 30% so that the magnetic field in the air gap is 1.3 times larger.

$$f_S = 30 \text{ Hz} \quad Q_{TS} = 0.307$$

- (c) Calculate the new  $f_S$  and  $Q_{TS}$  if the mass of the diaphragm of the original driver is doubled.

$$f_S = 21.2 \text{ Hz} \quad Q_{TS} = 0.706$$

- (d) On the same axes, sketch and label the normalized Bode magnitude plots (asymptotic and actual) for the low-frequency response of the original driver and the three modified drivers. Distinguish between the curves with labels.

3.
  - (a) What is the basic difference between a free-field microphone and a cavity microphone?
  - (b) In modeling the responses in the audio frequency band, the transfer functions for condenser, dynamic, and ribbon microphones are either second-order high-pass, low-pass, or band-pass. Identify the type of transfer function for each microphone.
  - (c) In modeling loudspeaker responses at low frequencies, the transfer functions for volume velocity, on-axis pressure, and diaphragm displacement are either second-order high-pass, low-pass, or band-pass. Identify the type of transfer function for each.