ELEC 435
Problem Set 11
Due: November 21, 2014

Homework Problems.

H11.1 A single-stack, variable reluctance stepper motor is to be designed having 200 full steps per revolution.

- **(a)** What is the minimum possible number of phases for this motor? For this number of phases, what number of stator poles should be used?
- **(b)** Using toothed (castellated) stator poles and a toothed rotor how many teeth should the rotor have? What is the maximum number of teeth per stator pole?
- **(c)** Sketch your design.

Quiz Problems.

Q11.1 Figure 1 shows a strain gage accelerometer, consisting of a mass of 0.1 kg attached to a steel beam with elastic modulus $E = 2 \times 10^{11}\mathrm{N/m}^2$. The dimensions of the beam are l=50 mm, x=40 mm, b=10 mm, and d=1 mm. A strain gage is attached to each side of the beam and connected as shown in Figure 2. Each gage has an unstrained resistance of 1 kΩ and a gage factor of 2.

- **(a)** Find the undamped natural frequency of the device (assuming that the mass of the beam is negligible).
- **(b)** Find the zero-frequency acceleration sensitivity at the amplifier output (assuming that the beam is critically damped).

Hint: A force F applied to the end of the beam produces a deflection at the free end of $\dfrac{4Fl^3}{Ebd^3}$ and a surface stress at distance x from the free end of $\dfrac{6Fx}{bd^2}$.

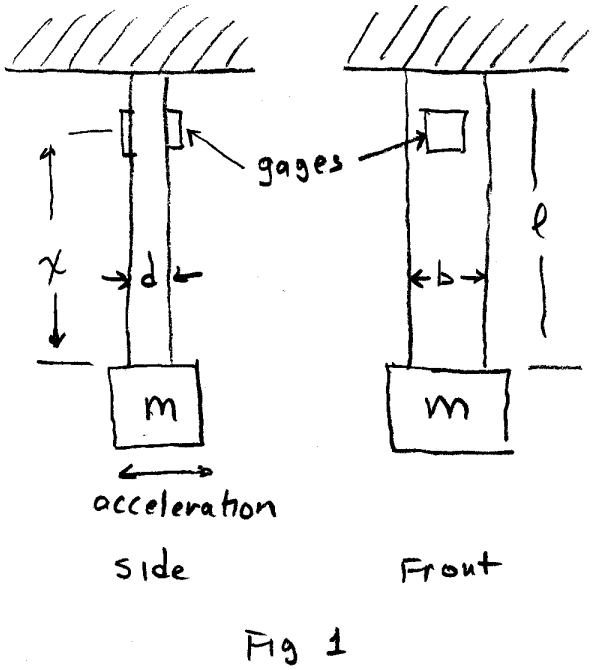

Fig 1

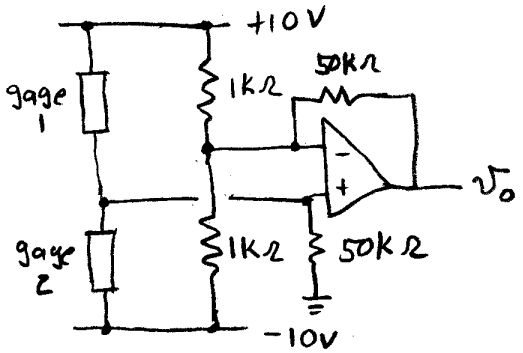

Fig 2