PROBLEM SET #6

Issued: Wednesday, April 13, 2016

Due: Friday, April 22, 2016, 8:00 a.m. in the EE C247B homework box near 125 Cory.

This homework assignment continues from Problem Set #5. Use the geometric dimensions and material properties given in Problem Set #5 whenever needed.



Fig. PS6-1 – Top view of the accelerometer given in Problem Set #5 with circuit connections.

1. Derive an expression for the capacitance between port A and B shown in Fig. PS6-1 as a function of displacement x using a parallel-plate approximation. Also, calculate the overlap capacitance between these two ports at rest.

- 2. Derive an expression for the capacitance between port A and C shown in Figure PS6-1 as a function of displacement y using a parallel-plate approximation. Also, calculate the overlap capacitance between these two ports at rest.
- 3. Suppose the accelerometer is now hooked up as shown in Figure PS6-1, with a DC bias V_{bias} of 10V applied to the structure.
 - i) Calculate the new *x* and *y*-directed resonance frequencies with this DC bias.
 - ii) If a sinusoidal force signal is applied to the structure in the *x*-direction with a magnitude of 1g, what will be the magnitude and phase of the resulting output current i_B as a function of frequency?
 - iii) If a sinusoidal force signal is applied to the structure in the *y*-direction with a magnitude of 1g, what will be the magnitude and phase of the resulting output current i_C as a function of frequency?