

UC Berkeley

EE C245 - ME C218 Introduction to MEMS Design Fall 2010

Prof. Clark T.-C. Nguyen

Dept. of Electrical Engineering & Computer Sciences
 University of California at Berkeley
 Berkeley, CA 94720

Lecture Module 12: Capacitive Transducers

EE C245: Introduction to MEMS Design LecM 12 C. Nguyen 11/18/08 1

UC Berkeley

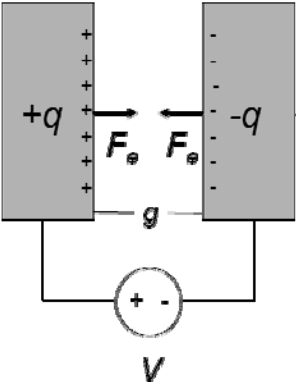
Lecture Outline

- Reading: Senturia, Chpt. 5, Chpt. 6
- Lecture Topics:
 - ↳ Energy Conserving Transducers
 - ↳ Charge Control
 - ↳ Voltage Control
 - ↳ Parallel-Plate Capacitive Transducers
 - ↳ Linearizing Capacitive Actuators
 - ↳ Electrical Stiffness
 - ↳ Electrostatic Comb-Drive
 - ↳ 1st Order Analysis
 - ↳ 2nd Order Analysis

EE C245: Introduction to MEMS Design LecM 12 C. Nguyen 11/18/08 2

UC Berkeley

Basic Physics of Electrostatic Actuation



- Goal: Determine gap spacing g as a function of input variables
- First, need to determine the energy of the system
- Two ways to change the energy:
 - ↳ Change the charge q
 - ↳ Change the separation g

$$\Delta W(q, g) = V\Delta q + F_e\Delta g$$

$$dW = Vdq + F_e dg$$

- Note: We assume that the plates are supported elastically, so they don't collapse

EE C245: Introduction to MEMS Design LecM 12 C. Nguyen 11/18/08 3