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EE C245 - ME C218 Introduction to MEMS Design Fall 2011

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Lecture Module 10: Resonance Frequency

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Lecture Outline

- Reading: Senturia, Chpt. 10: §10.5, Chpt. 19
- Lecture Topics:
 - ↪ Estimating Resonance Frequency
 - ↪ Lumped Mass-Spring Approximation
 - ↪ ADXL-50 Resonance Frequency
 - ↪ Distributed Mass & Stiffness
 - ↪ Folded-Beam Resonator

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Estimating Resonance Frequency

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Clamped-Clamped Beam μ Resonator

Resonator Beam
 W_r , L_r , h

Electrode
 v_i

Voltage-to-Force Capacitive Transducer
 V_P

Sinusoidal Excitation
 $v_i = V_i \cos[\omega_0 t] \rightarrow f_i = F_i \cos[\omega_0 t]$

Sinusoidal Forcing Function
 i_o

$Q \sim 10,000$

$\frac{i_o}{v_i}$ vs ω

ω_0

- $\omega \neq \omega_0$: small amplitude
- $\omega = \omega_0$: maximum amplitude \rightarrow beam reaches its maximum potential and kinetic energies

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