Announcements:
- HW#5 online & due Wednesday, 3/10, at 12 noon
- This lecture finishes Lecture 14 from where Lecture 14a left off
- It is happening during the first portion of the Friday discussion section
- Afterwards, we will look at HW#5 a bit

Today:
- Reading: Senturia, Chpt. 9
- Lecture Topics:
  - Bending of beams
  - Cantilever beam under small deflections
  - Strain Gradients
  - Combining cantilevers in series and parallel
  - Folded suspensions
  - Design implications of residual stress and stress gradients

Last Time:
- Finished strain gradients
- Now, tackle beam combos, starting with folded-beam suspensions

How to Defend Against This?
1. Change or optimize process parameters -> deposition
   - problem: can't always do this
2. Design -> folded beam!
Typical Questions:  
1. How does the structure move in response to a force at a specific location?  
2. What is the frequency response to an AC force applied at a specific location?  
3. Noise?  
4. Response to environmental stimuli? (e.g., rotation)  
5. How does stress affect the behavior of the structure?

Procedure:  
1. Build the circuit (extract the circuit) in the x-direction (for this example)  
   - Analyze to get $x = f(F)$  
   - $F = kx \rightarrow x = \frac{E}{k}$  
   - Compliance

   (a) Case 1: series spring  
   - $k_{tot}$, total stiffness  
   - $\kappa_{tot} \cdot (k_{tot}F)$  
   - Need $\kappa_{tot}$
\( \chi_1 = \frac{F}{k_1}, \chi_2 = \frac{F}{k_2} \)  

\[ F \left( \frac{1}{k_1} + \frac{1}{k_2} \right) = \frac{F}{k_{tot}} \]

\[ [ \frac{1}{A+B} = \frac{1}{A+1/B} = \frac{AB}{A+B} ] \]

\[ k_{tot} = k_1 k_2 \] (for \( k_1, k_2 \) in series)

For EE's: Springs combine like capacitors

\[ \frac{1}{C_1} \frac{1}{C_2} = \frac{1}{C_{11C_2}} \]

(b) Case 2: Parallel Springs

\[ F_2 = k_2 \chi_{tot} \]

\[ F = F_1 + F_2 = k_1 \chi_1 + k_2 \chi_{tot} \]

\[ F = (k_1 + k_2) \chi_{tot} \]

\[ k_{tot} = k_1 + k_2 \] (for \( k_1, k_2 \) in parallel)