DESIGNING A STRESS/STRAIN APPARATUS FOR ORGANIC FIELD-EFFECT TRANSISTORS

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So what's happening in the Kagan Lab?

- What are there applications?
- What advantages do they bring?
- How is my project involved?

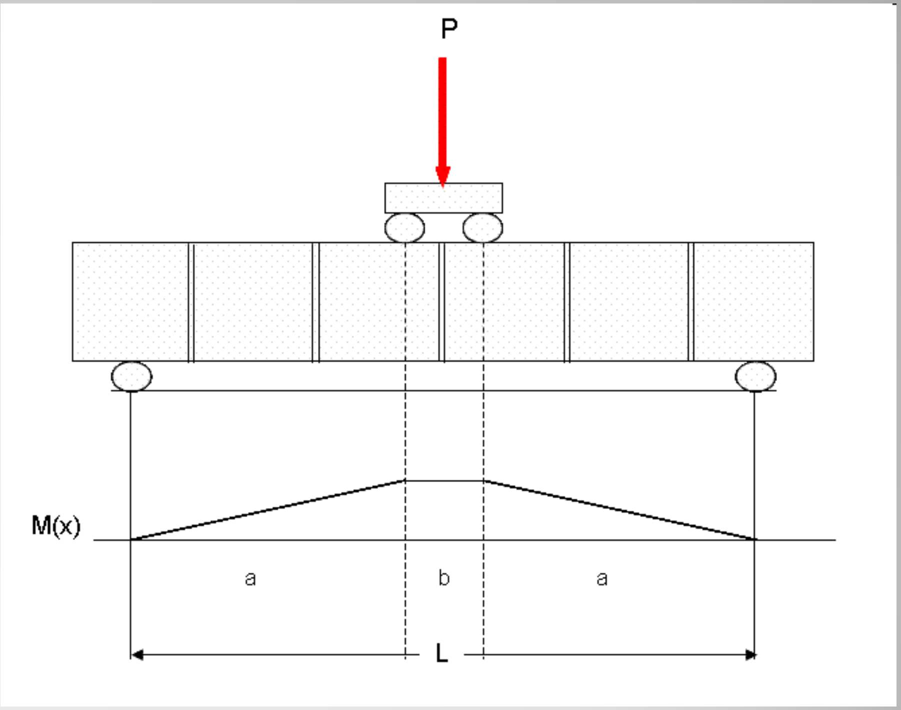
Field-Effect Transistors (FETs)

How to bend a FET?

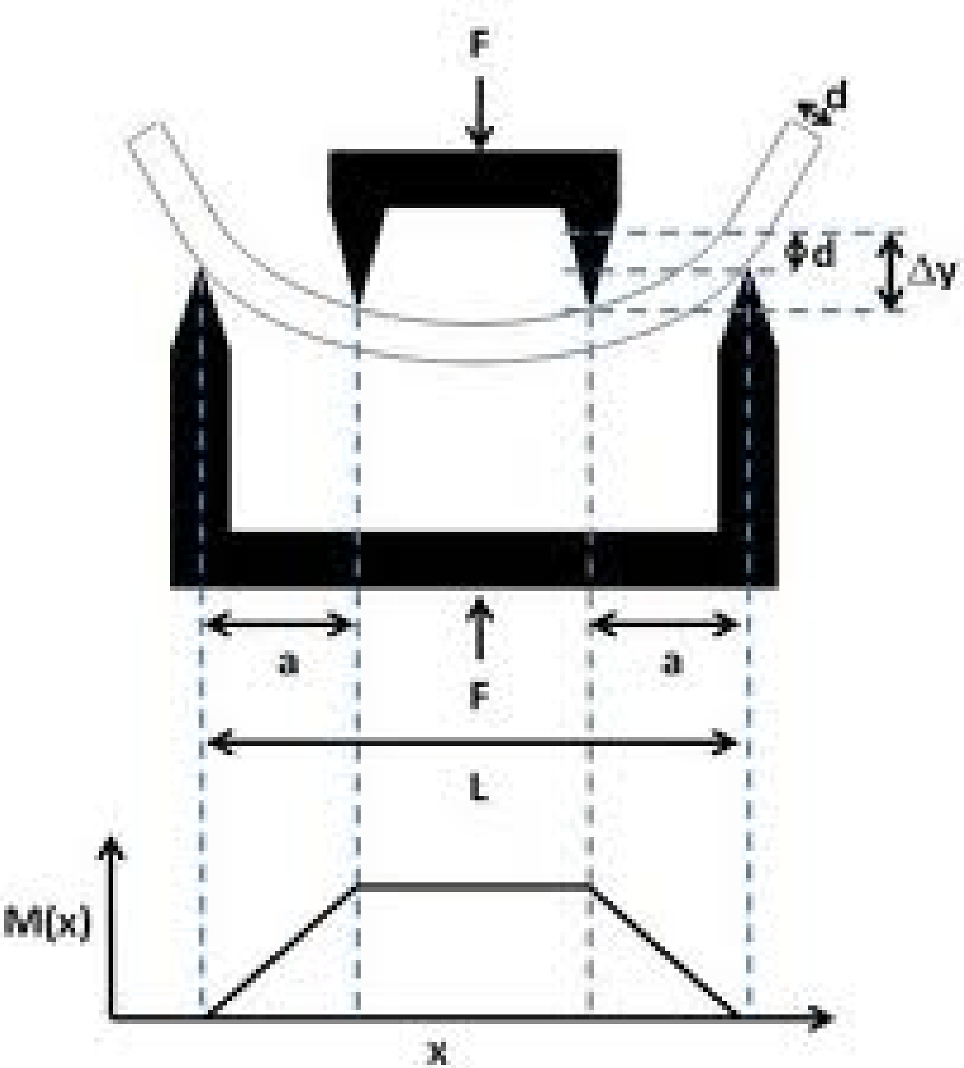
- Use an instron to induce the bend
- Use a mandrel to induce the bend
- Bend the device across something with a fixed diameter (i.e. cylinder)

Four-Point Bending

- Four points of contact with the substrate
- Bending moment varies with position
- Constant bending moment within "**b**"
- Constant radius of curvature



Four-Point Bending as a quantitative analysis



Bending Moment

Regions **a** $$EI\frac{d^2y}{dx^2} = M(x) = \frac{F}{2}x$$

Center $$EI\frac{d^2y}{dx^2} = M(x) = \frac{F}{2}a$$

Deflection

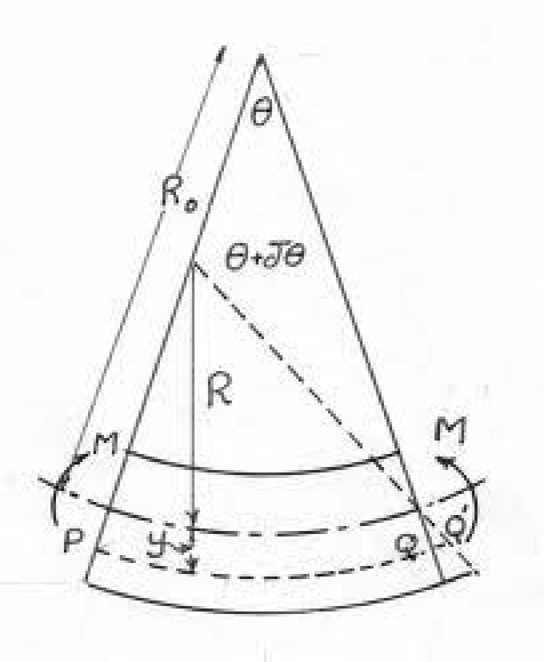
Regions **a** $$y(x) = \frac{1}{EI}\left[\frac{Fx^3}{12} + Fa\left(\frac{a}{4} - \frac{(L/2)}{2}\right)x\right]$$

Center $$y(x) = \frac{1}{EI}\left[\frac{Fa}{4}x^2 + \frac{Fa^3}{12} - \frac{Fa(L/2)}{2}x\right]$$

E = Young’s Modulus
I = Moment of inertia

Four-Point Bending as a quantitative analysis cont.

Center/Region **b**



Strain

$$\varepsilon = \frac{\sigma}{E}$$

Radius of Curvature/Bending Moment Relation

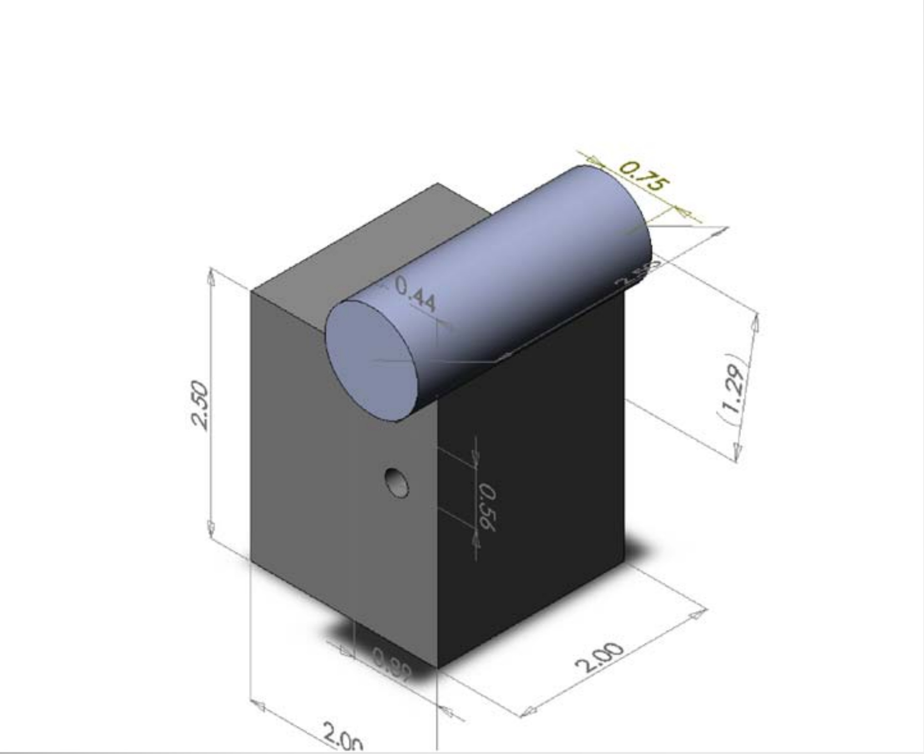
$$\frac{1}{\rho} = \frac{M(x)}{EI}$$

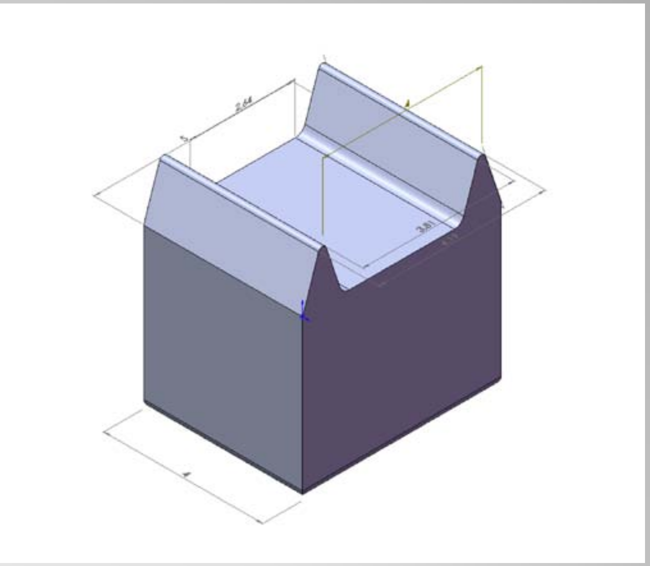
Stress

$$\sigma = \frac{M(x)c}{I}$$

So where are we now?

Designing Custom Parts





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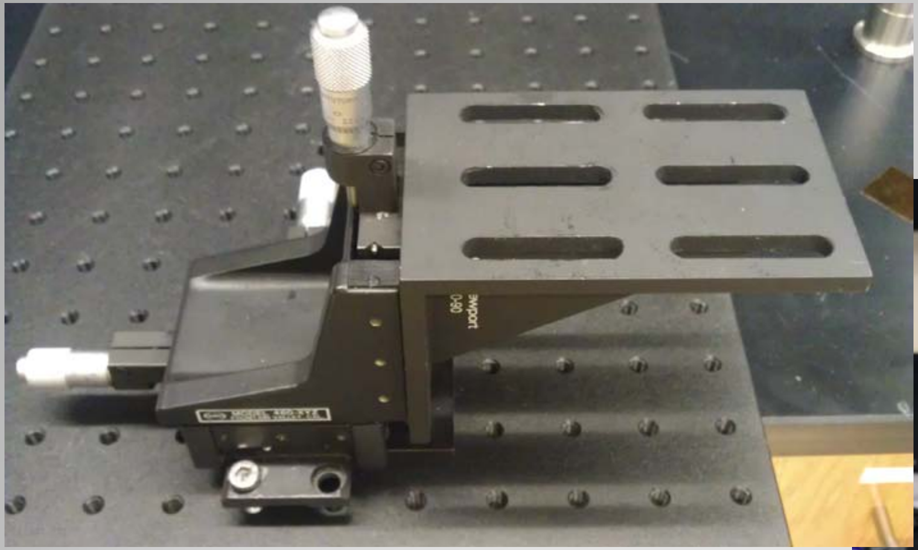
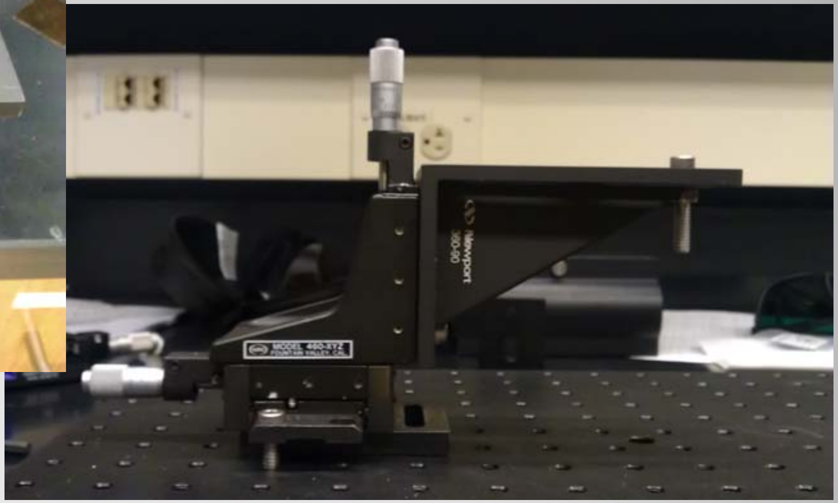
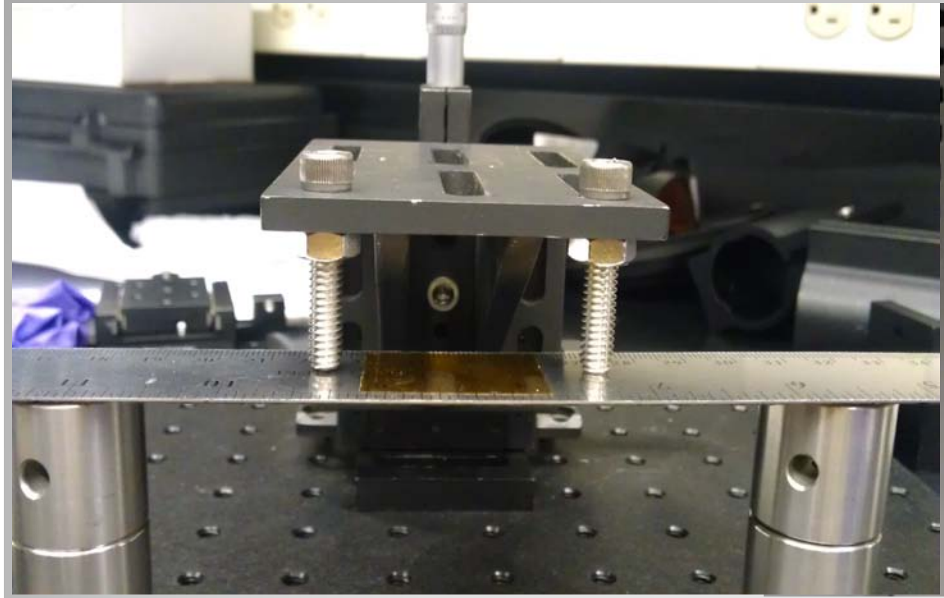
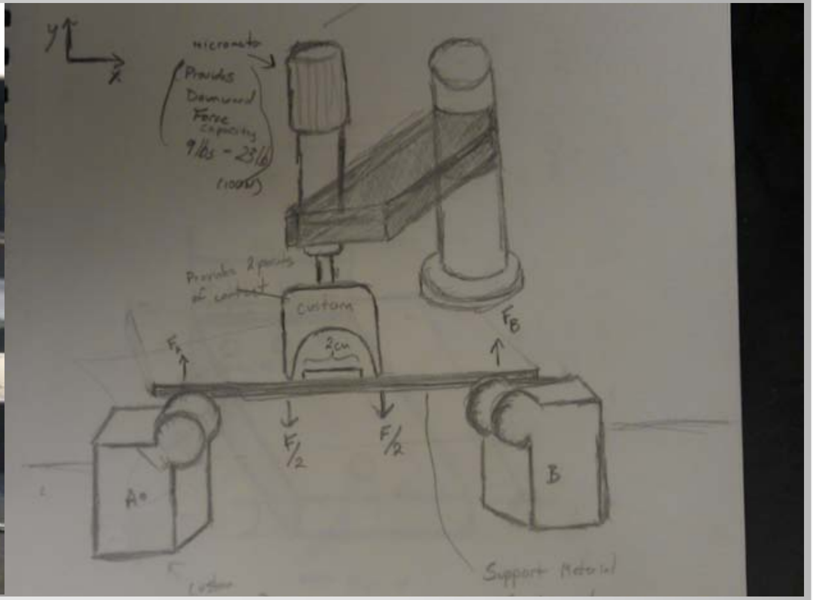




Applying the downward force on the apparatus using a precision mechanical stage setup

Hopeful End Result





We hope to have a four-point bend apparatus that will resemble the conceptualized designs above

Future Work

- Testing the effectiveness of the apparatus
- Bending the transistors and observing any changes in their properties
- Comparing the tested results with the quantitative solutions
- Reconfiguring the transistors to perform better if needed

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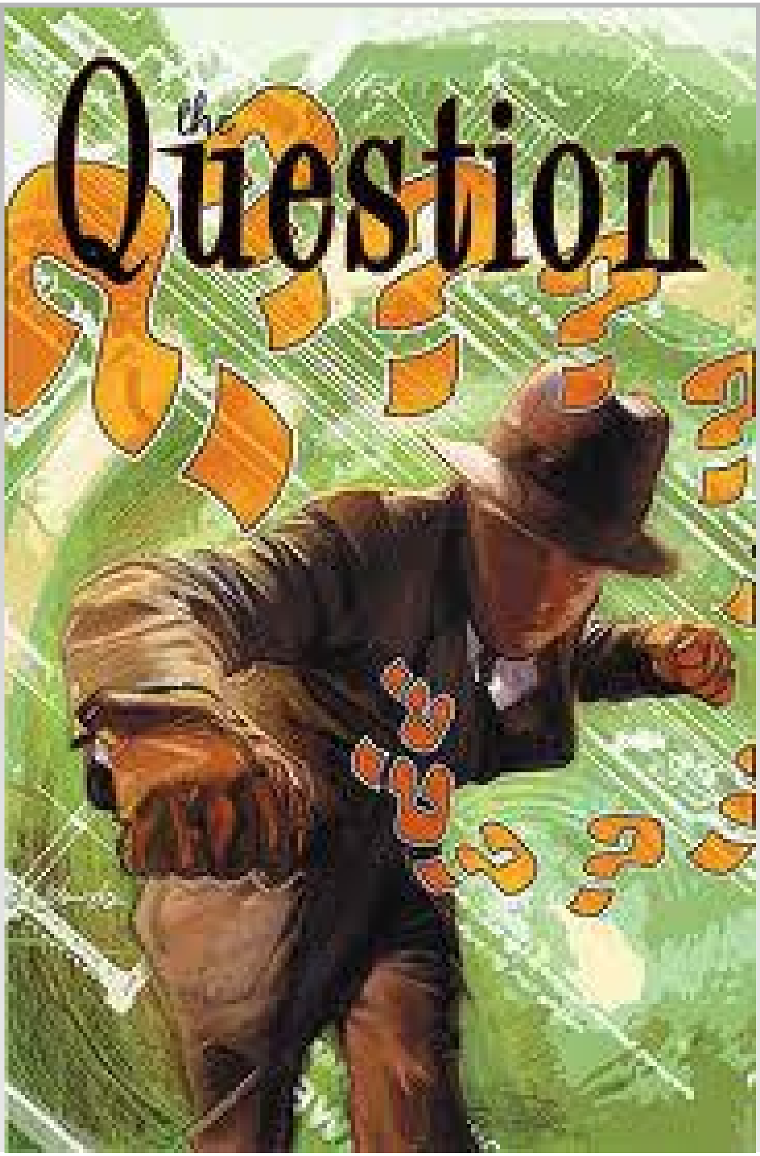
the Question