EE 247B / ME 218 Discussion 6

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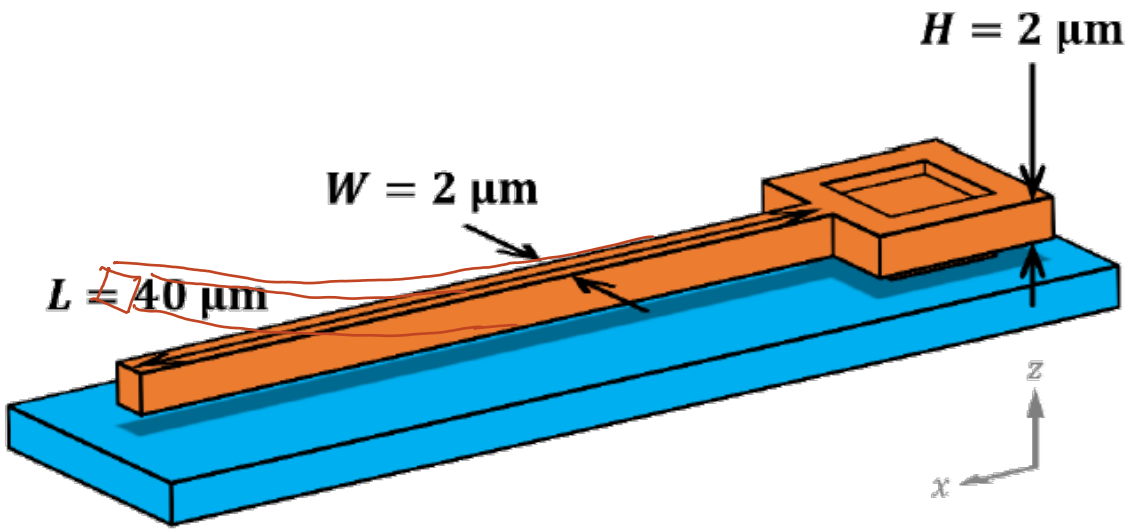
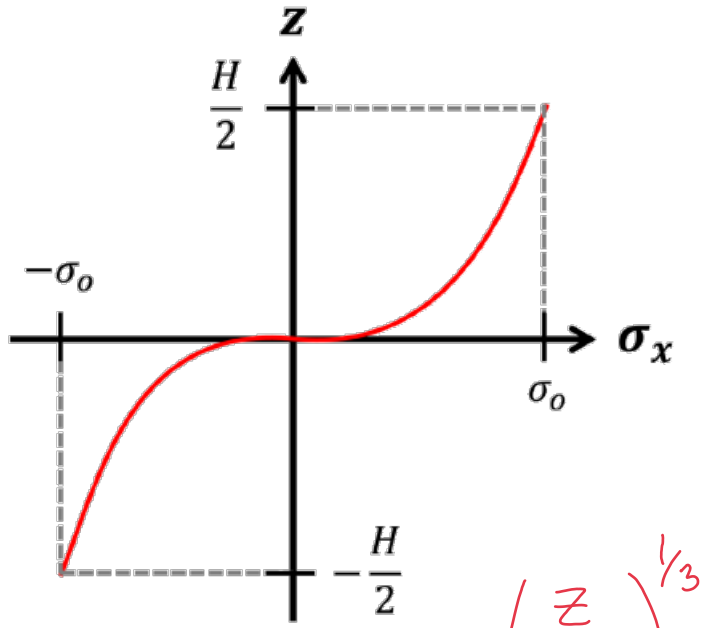
HW4, Problem 1



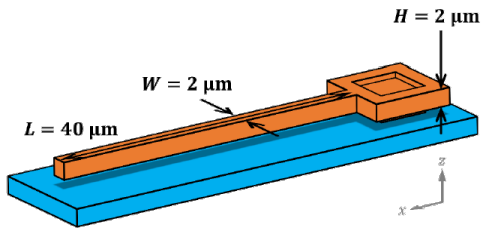


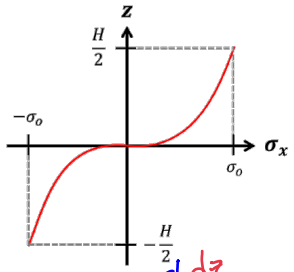
$\sigma_x(z) = Az^{1/3}$

$\sigma_x(z) = A\left(\frac{H}{2}\right)^{1/3} = \sigma_o = 10^7\ Pa$

$\sigma_x(z) = \sigma_o\left(\frac{z}{H/2}\right)^{1/3}$

HW4, Problem 1





Total internal bending moment:

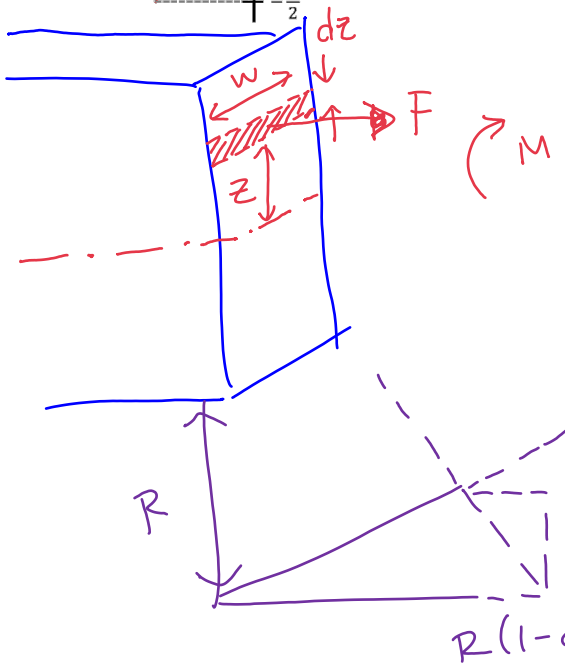
$$M = \int_{-H/2}^{H/2} \sigma_x \cdot A \cdot z = \int_{-H/2}^{H/2} \sigma_0 \left(\frac{z}{H/2}\right)^{1/3} W z\, dz$$

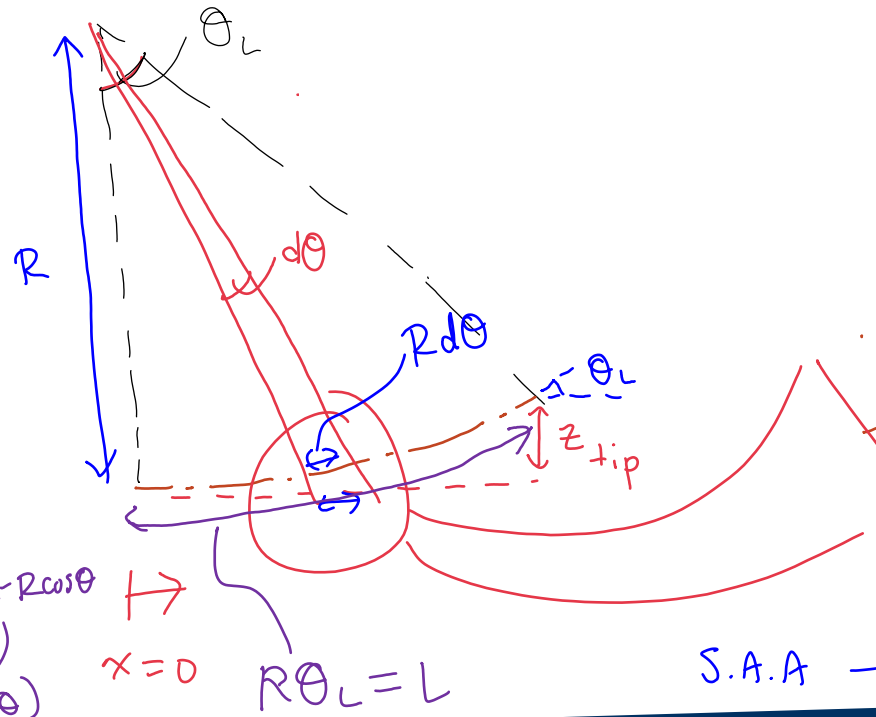
$A = W dz$

$M \Rightarrow R$

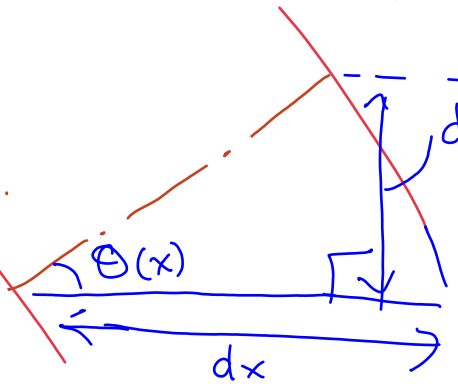
$$\frac{1}{R} = -\frac{M}{EI}$$

$$\frac{WH^3}{12}$$





$$z_{tip} = \int_0^{z_{tip}} dz = \int_0^L \theta(x)\, dx$$



$$= \int_0^{\theta_L} \theta R\, d\theta$$

$$dz = \tan(\theta(x))\, dx$$

S.A.A $\rightarrow$ $= \theta(x)\, dx$

$$z_{tip} = \frac{\theta_L^2 R}{2} = \frac{L^2}{2R}$$

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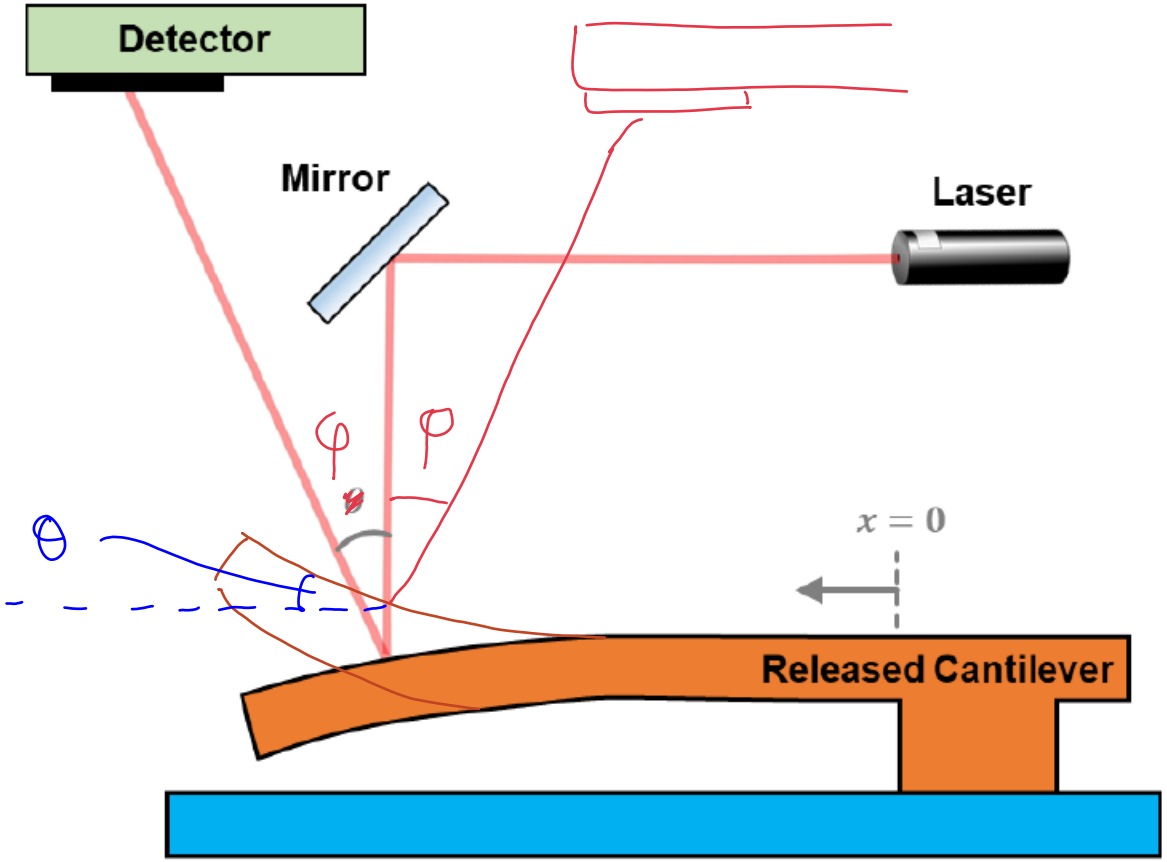

$\theta = \frac{\varphi}{2}$

$\varphi(x) = 2\,\theta(x)$

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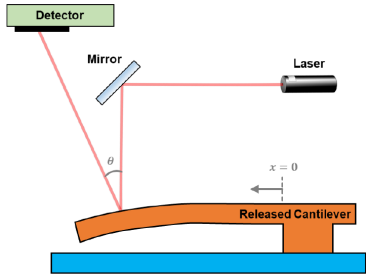


$$\frac{1}{R} = -\frac{M}{EI} = \frac{\partial^2 z}{\partial x^2}$$

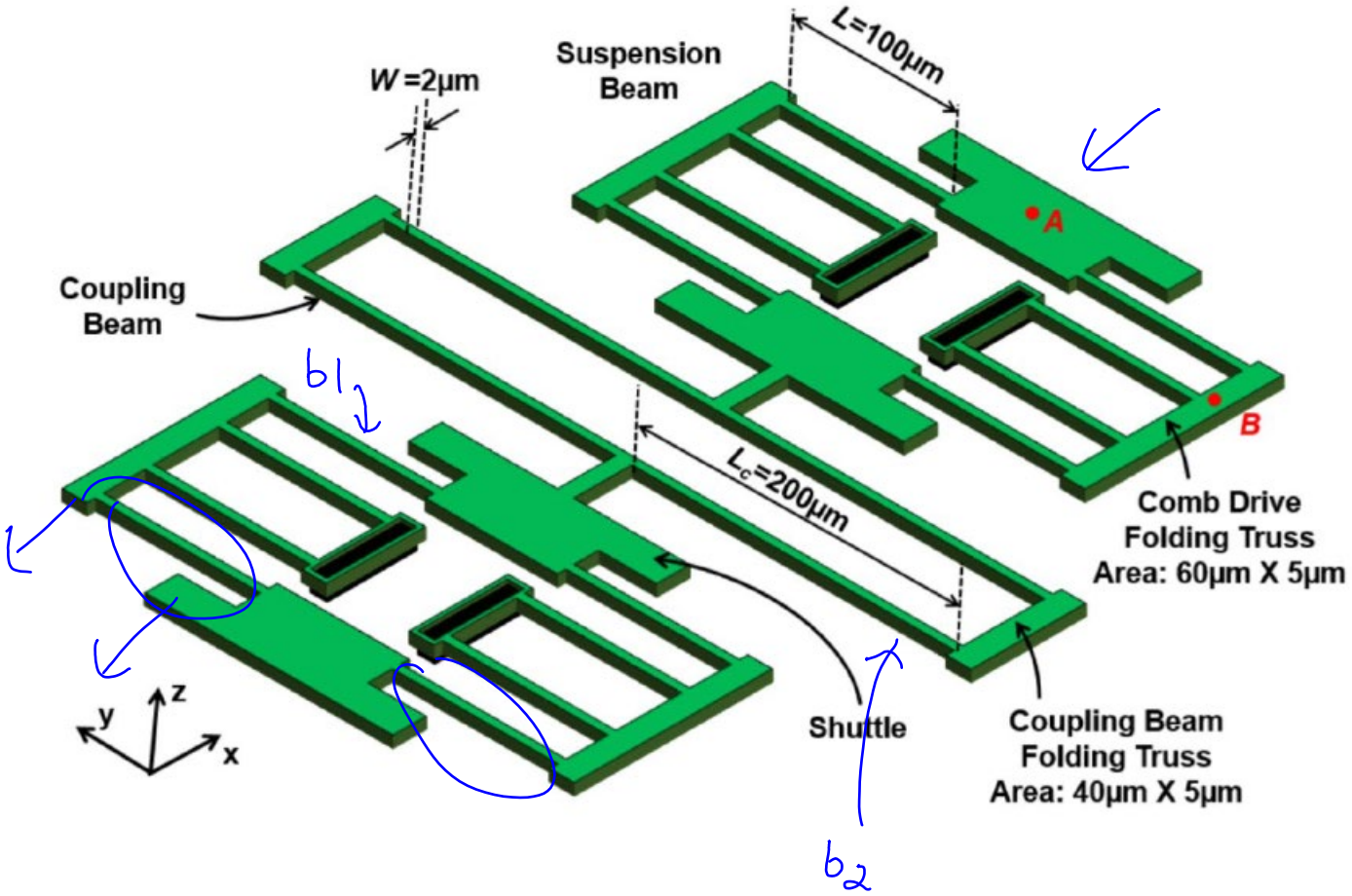
$$\frac{\partial z}{\partial x} = \frac{x}{R} + C_0 \Rightarrow \left.\frac{\partial z}{\partial x}\right|_{x=0} = 0 \quad \therefore C_0 = 0$$

integrate

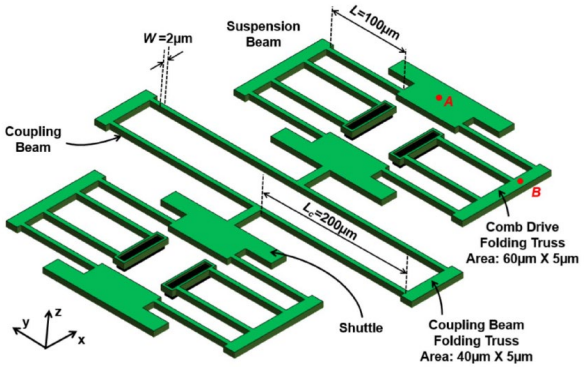
$$\theta(x) = \frac{x}{R}$$

$$z(x) \Rightarrow z(L) = z_{tip}$$

HW4, Problem 2

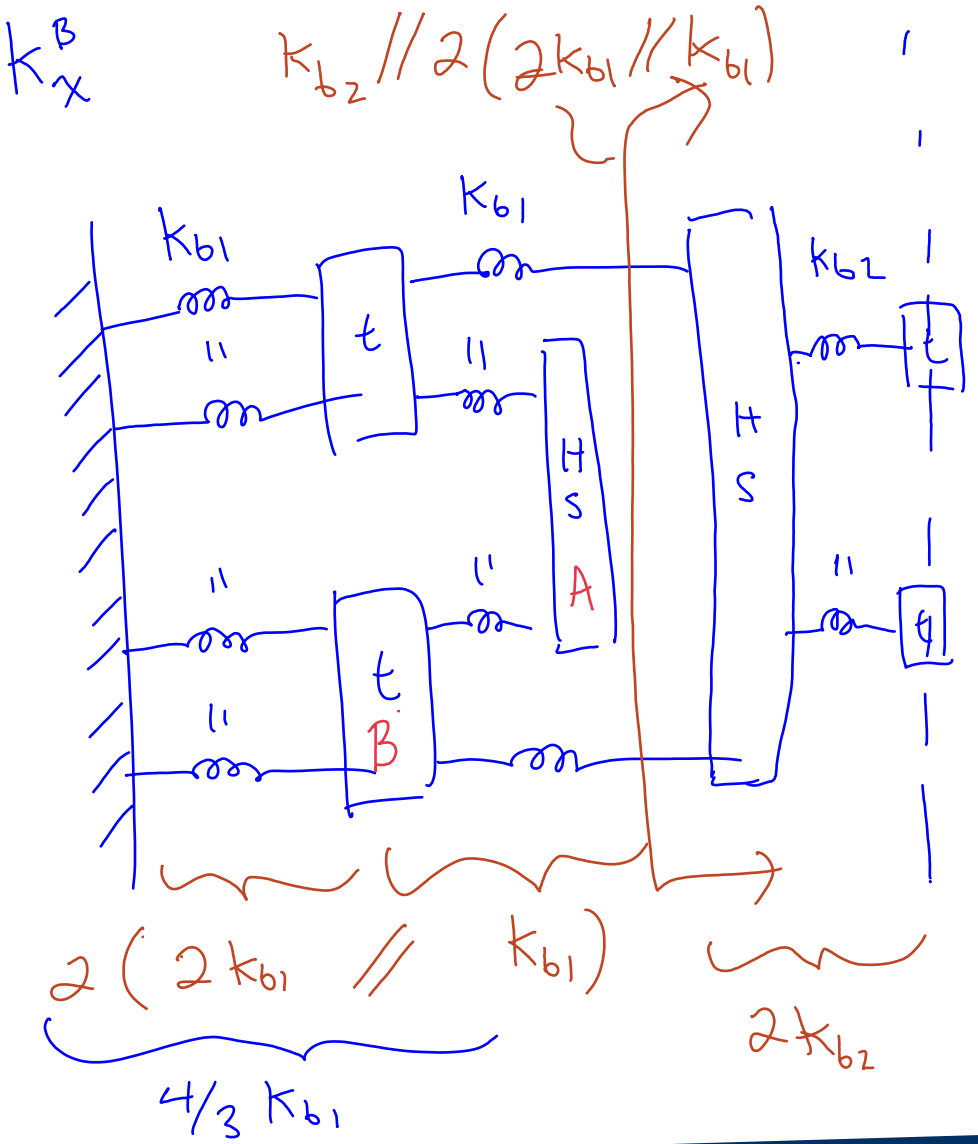


HW4, Problem 2



$$k_{b1} = \frac{k_{c1}}{2}$$

$$k_{c1} = \frac{E w^3 h}{(L_{b1}/2)^3}$$



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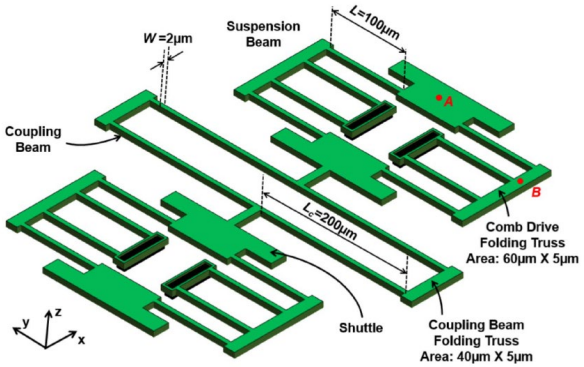

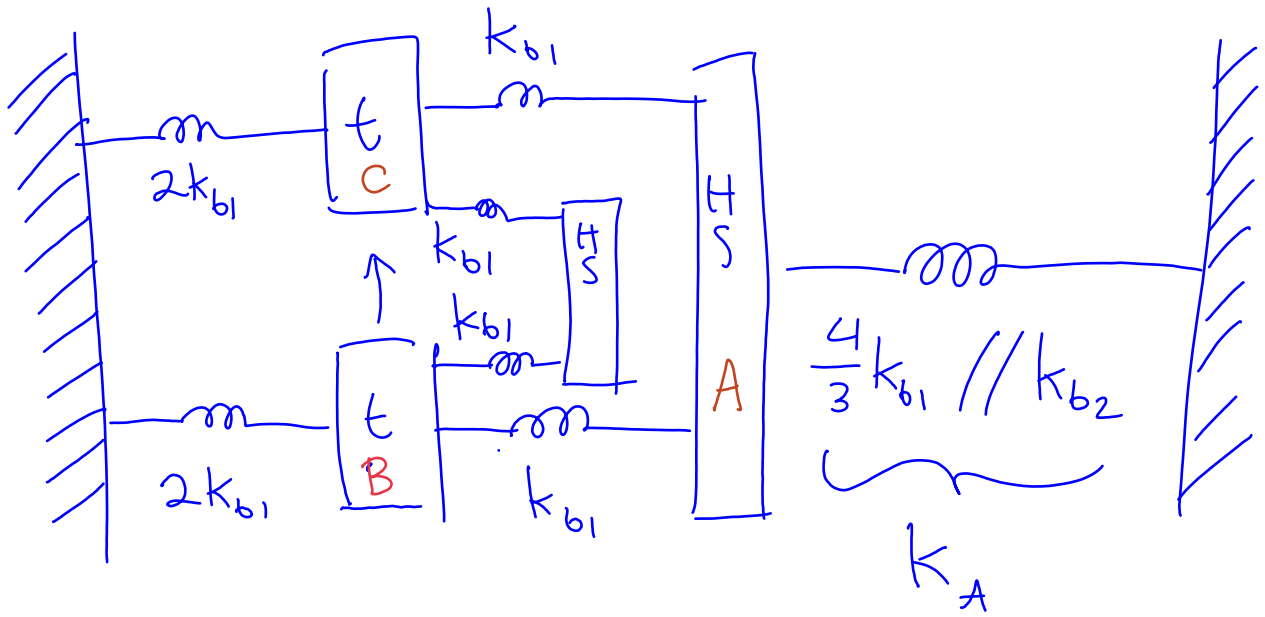

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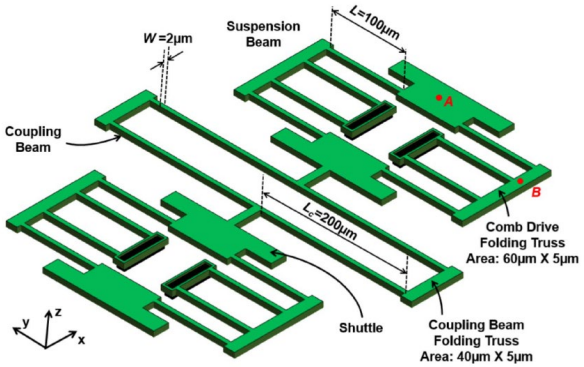
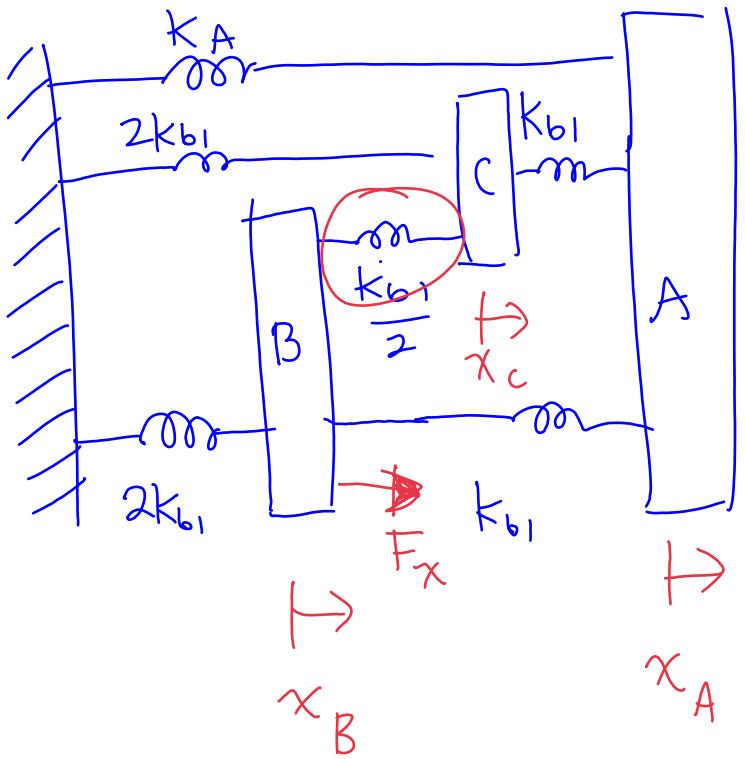


$F_x = k_x^B x_B$

$k_x^B = \frac{x_B}{F_x}$?

$x_A < x_c < x_B$



@A

$|x_B - x_A| k_{b1} + |x_c - x_A| k_{b1} - k_A x_A = 0$

spring A↔B | spring A↔C | spring between A & anchor

@B

$F_x - |x_B - x_A| k_{b1} - |x_B - x_c| \frac{k_{b1}}{2}$

$-2k_{b1} x_B = 0$