

Folded-Beam Suspension

- Use of folded-beam suspension brings many benefits
 - Stress relief: folding truss is free to move in y-direction, so beams can expand and contract more readily to relieve stress
 - High y-axis to x-axis stiffness ratio

Comb-Driven Folded Beam Actuator

Folding Truss

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Folded-Beam Stiffness Ratios

- In the x-direction:

$$k_x = \frac{24EI_z}{L^3}$$
- In the z-direction:
 - Same flexure and boundary conditions
 - $$k_z = \frac{24EI_x}{L^3}$$
- In the y-direction:
 - [See Senturia, §9.2] $k_y = \frac{8EWh}{L}$
- Thus:

$$\frac{k_y}{k_x} = 4 \left(\frac{L}{W} \right)^2$$

Much stiffer in y-direction!

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Folded-Beam Suspensions Permeate MEMS

Accelerometer [ADXL-05, Analog Devices]

Gyroscope [Draper Labs.]

Micromechanical Filter [K. Wang, Univ. of Michigan]

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Folded-Beam Suspensions Permeate MEMS

- Below: Micro-Oven Controlled Folded-Beam Resonator

Temperature Sensing Resistor

Heating Resistor

Support Struts

Substrate Edge

Micro-Platform

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