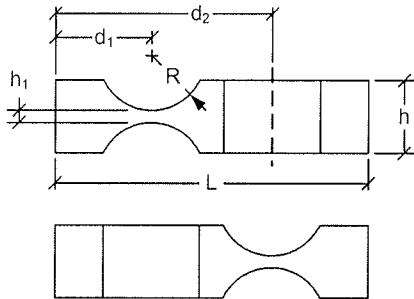


HW 11 Solution

Problem 1: Design and Calculate the Compliance for Three Flexure Types

a) 2-axis hinge flexure



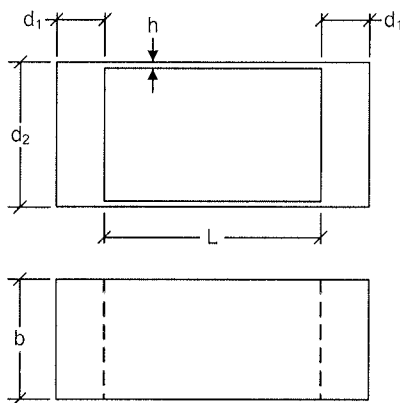
h	10 mm
h1	1 mm
R	25 mm
d1	25 mm
d2	75 mm
L	100 mm
E	210 GPa

Flexure compliance:

$$\frac{\delta}{M} = \frac{9\pi R^{1/2}}{2Ehh_1^{3/2}} = \frac{9\pi(25\text{mm})^{1/2}}{2(210\text{GPa})(10\text{mm})(1\text{mm})^{3/2}}$$

$$\frac{\delta}{M} = 3.37 \times 10^{-14} \frac{\text{rad}}{\text{N}\cdot\text{m}}$$

b) Linear translation flexure

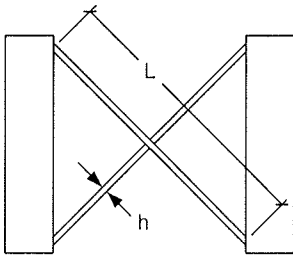


d1	10 mm
d2	10 mm
h	1 mm
L	100 mm
b	50 mm
E	210 GPa

Flexure compliance: $\frac{\delta}{W} = \frac{L^3}{2Ebh^3} = \frac{(100\text{ mm})^3}{2(210\text{ GPa})(50\text{ mm})(1\text{ mm})^3} = 4.76 \times 10^{-11} \frac{\text{mm}}{\text{N}}$

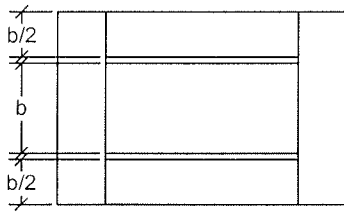
Stiff direction: $\frac{\delta}{W} = 2 \frac{L^3}{3EI} = \frac{8L^3}{Ehb^3} = \frac{8(100\text{ mm})^3}{(210\text{ GPa})(1\text{ mm})(50\text{ mm})^3} = 3.05 \times 10^{-13} \frac{\text{mm}}{\text{N}}$

c) Two Strip Flexure Pivot



L	100 mm
h	1 mm
b	50 mm
E	210 GPa

✓



Angular compliance:

$$\frac{\theta}{M} = \frac{L}{EI} = \frac{12L}{E(2b)h^3} = \frac{6L}{Ebh^3} = \frac{6(100 \text{ mm})}{(210 \text{ GPa})(50 \text{ mm})(1 \text{ mm})^3} = 5.71 \times 10^{-14} \frac{\text{rad}}{\text{N} \cdot \text{m}}$$