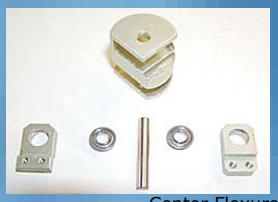
Flexures

Definition of Flexure
Flexures are joints connecting solid members and permitting relative motion in some directions while constraining motion in others.


Center Flexure

Why Flexures?
- Both Friction and Stiction are not measurable
- High stiffness
- No internal friction
- Relatively high load capacity
- Resistant to shock
- Low sensitivity to vibration
- Absence of wear
- No mechanical play

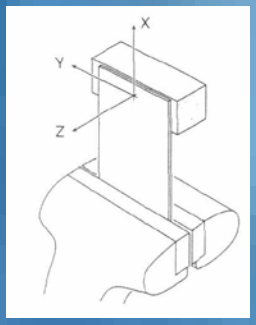

Anchor Flexure

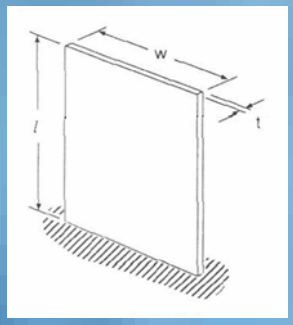
Applications
- Micro-Electrical-Mechanical Systems
- High Performance Vehicles
- Astronautics
- Measurement devices

Stiffness Calculation for ideal sheet Flexures

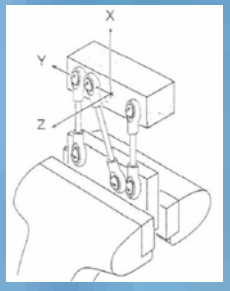
$$k_x = \frac{AE}{l} = \frac{wtE}{l}$$

$$k_z = \frac{3\left(\frac{wt^3}{12}\right)E}{t^3} = \frac{wt^3E}{4t^3}$$

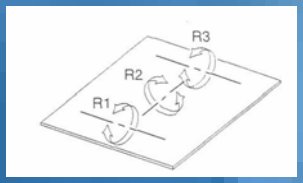




Ideal sheet flexure



Bar equivalent to ideal sheet flexure



Degrees of freedom in sheet flexure model

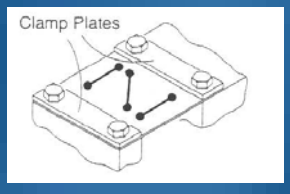


Figure A

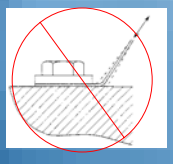
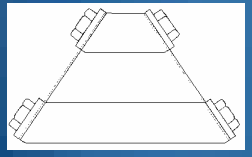


Figure C



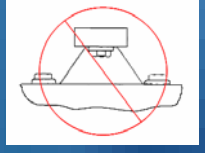


Figure B

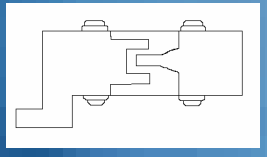


Figure D

Limitations to Flexures
- Travel is typically no more than 10-15% of the major diameter
- Angle of rotation limited to <15 degrees
- Fatigue and Strain hardening

Tips on Flexure Connections
- Use clamp plates when attaching sheet flexures (Figure A)
- Always use flexures in their nominally flat (straight) condition, never substantially curved (Figure B)
- No bend at attachment (Figure C)
- Provide limit stops to prevent accidental overtravel (Figure D)