DESIGN OF CONSTRAINT LECTURE

Design of constraints in precision systems

Background

- History
- Reasons
- Requirements
- Problems

Classes of Constraint

- Kinematic
- Quasi-Kinematic
- Variable Geometry
- Partial/Compliance

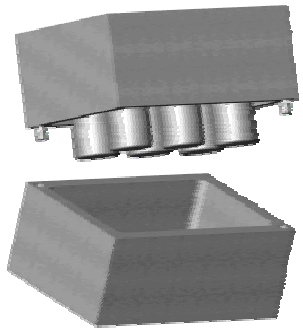
Hardware/discussion time

Elastic Averaging will be done next lecture

Common coupling methods

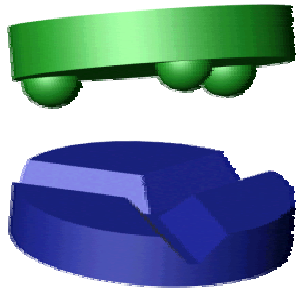
Elastic Averaging

Non-Deterministic



Pinned Joints

No Unique Position

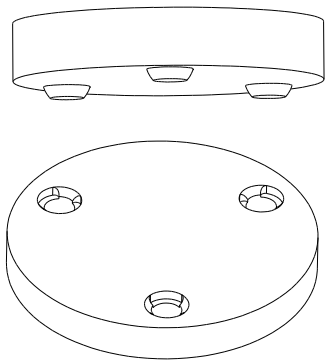


Kinematic Couplings

Kinematic Constraint

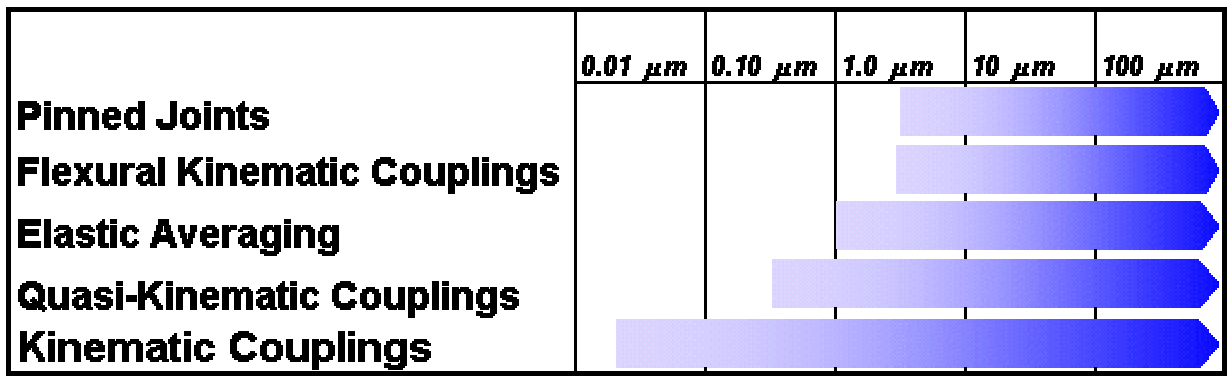
Flexural Kin. Couplings

Kinematic Constraint



Quasi-Kinematic Couplings

Near Kinematic Constraint



Perspective: What the coupling designer faces…

APPLICATION	SYSTEM SIZE	REQ'D PRECISION
Fiber Optics	Meso	Nano
Optical Resonators	Meso	Nano
Large array telescopes	60 ft diam.	Angstrom
Automotive	3 ft	1 micron

Problems due to strain affects

- Thermal Affects — Air, hands, sunlight
- Gravity — Sagging
- Stress Relief — Time variable assemblies
- Loads — Stiffness

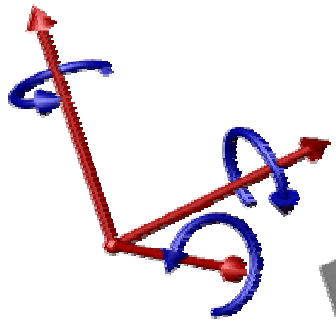
Problems due to sub-optimal designers

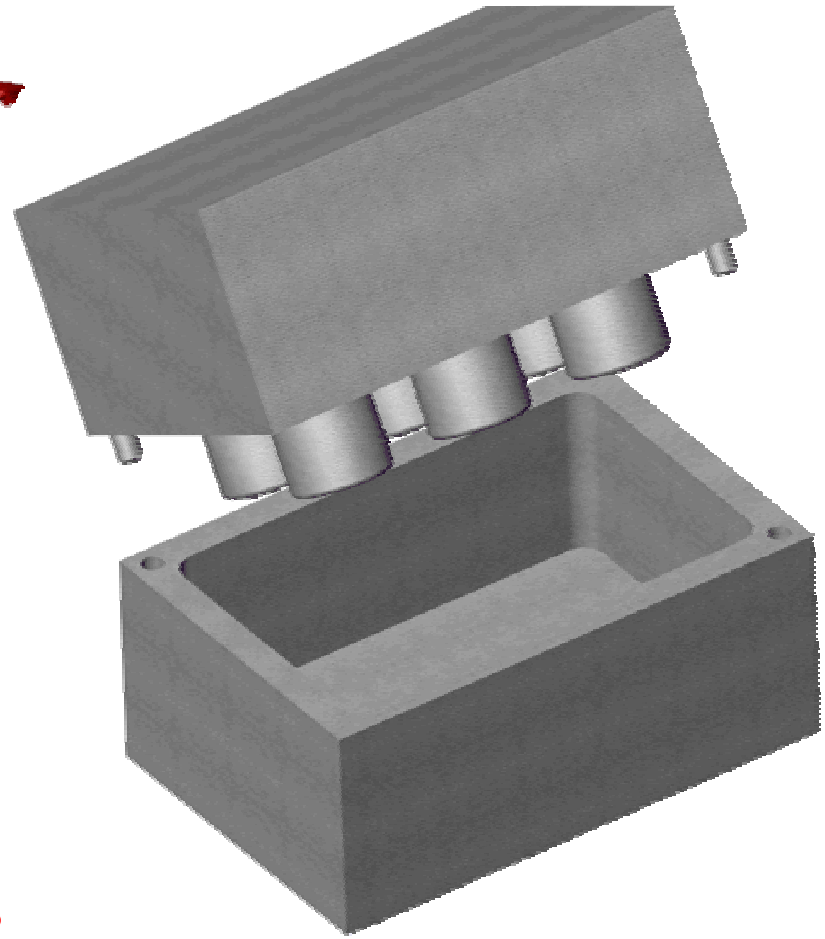
- Competing cost vs performance
- Automotive (no temperature control, large parts, resistance to change)

General service requirements & applications

Ideal couplings:

- Inexpensive
- Accurate & Repeatable
- High Stiffness
- Handle Load Capacity
- Sealing Interfaces
- Well Damping





Example Applications:

- Grinding
- Optic Mounts
- Robotics
- Automotive

Sensitivity

- What are the sensitive directions?!?!?!?!?

Couplings are designed as systems

You must know what is going on (loads, environment, thermal)!

Shoot for determinism or it will "suck to be you"