2.72 Elements of Mechanical Design
Spring 2009
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Elements of Mechanical Design

‘Lecture’ 11:
Screw drives
Schedule and reading assignment

Quiz
- Bolted joint qualifying Thursday March 19th

Topics
- Screw drive group activity - 90% hands on

Reading assignment
- *Read:*
  13.1 – 13.7
  17.1 & 17.3
- *Skim:*
  Rest of Ch. 17
Screws

Convert rotary motion into linear motion:

Types of “lead screws”:
- Sliding contact thread lead screws
- Ball screws
- Hydrostatic lead screws
- Others
Typical screw types

Image by jgelens on Flickr.

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http://news.thomasnet.com/images/large/455/455175.jpg
Errors

Some error sources

- Misalignment
  - Bearings, Carriage

- Geometry
  - Straightness
  - Varying pitch diameter (periodic error and backlash)
  - Errors in thread-contacting elements

- Loads
  - Elastic
  - Vibration

Active error management

- Periodic errors can be mapped
- Linear position sensors
Preload – why…

**Nut-screw:**
- Backlash
- Use two nuts that are preloaded against each other
- Use oversize rolling elements
- Use a split-circumferentially clamped nut

**Screw-machine:**
- Backlash
- Buckling
- Straightness
- Vibration
Cross feed design exercise

Kinematic (trade off)

Loads and power (limits)

Constraints (bearing, flexure?)

Preload (Nut-screw and screw-machine)

Stress/fatigue

Errors (Causes, systematic, random)