Sketching and Drawings

2.007 Spring 2009
Prof. David Gossard
Lecture topics (tentative)

- Sketching & Drawings
- Modeling basic components 1
- Modeling basic components 2
- Making drawings
- Assemblies
- Case studies

{CAD}
Objectives

- Enable you to
  - Communicate ideas about physical objects in isometric sketches
  - Understand and create working drawings
  - Create CAD models (parts, drawings, assemblies)

- Caveats:
  - These lectures are only a start, i.e. the basics
  - Mastery requires practice and time
Reminder

- To those who’ve “seen it before”:
  - Bear with us
  - Help those who haven’t
Terminology

- **Sketch**
  - Rough, approximate
  - Communicates general shape & proportion
  - Quick, cheap
  - Produced by hand or with simple tools

Courtesy of Martin Culpepper. Used with permission.
Terminology

- **Drawing**
  - Precise, complete
  - Sufficient to enable fabrication or assembly
  - Not quick, not cheap
  - Produced with tools, esp. computers

Courtesy of Sang-Gook Kim and Jung-Hoon Kim. Used with permission.
Isometric Sketching

- 3 axes
  - 1 vertical
  - 2 inclined 30° wrt to horizontal

- Lines parallel to axes are true length
  - Used to establish scale

Not true length

Courtesy of Julie Arnold. Used with permission.
Exercise 1

Make an isometric sketch (twice) of:

- a 6-inch long “2x4”, half-scale, lying flat

  - Long axis up & to the right
  - Long axis up & to the left
Sketching circles

- Normal: Circle
  - Bounding square
  - Tangency at midpoints
  - Proportion at mid-arc
    - Diagonals? (optional)
Sketching isometric circles

- **Isometric: Ellipse**
  - Bounding rhombus
  - Tangency at midpoints
  - Proportion at major & minor axes

- **Sketching circles on principal planes**
  - Ellipses in different orientations
  - Cube, tangent points, curves
Sketching isometric cylinders

- **Tangent lines**
  - normal to plane of ellipse
  - leave from ellipse’s major axis, NOT from tangency points!

- **Rookie error**
Exercise 2

- Sketch a block letter “L”
  - 1 x 1 base
  - 1.5 height
  - 0.25 thickness
- Sketch fillets on the 4 shortest edges (0.25 radius)
- Sketch a hole through the vertical face (0.5 diameter)
PRACTICE !!!
Drawings

- Are a special language for communicating about physical objects
  - Reading
  - Writing
- Can be a legal definition
- 3+ types of information:
  - Shape
  - Nominal dimensions
  - Tolerances
    - Other attributes (e.g. finish)
Orthographic Projection

- Outline of 3D object projected onto 2D plane
  - Transparent plane in front of the 3D object
  - Important points projected onto plane and connected
    - normal to plane
- One “view” of the object (planar)

Image from Wikimedia Commons, http://commons.wikimedia.org
Principal Views

- “Glass Box” organization
- Multiple planes give multiple views
- Views are aligned
Principal Views (2D)

- 6 principal views
- Views are aligned
View Selection

- **Non-symmetric parts:**
  - Front, side, top
  - Front = largest

- **Axially symmetric parts** often need only 2 views

---

Image from Wikimedia Commons, http://commons.wikimedia.org

 Courtesy of Sang-Gook Kim and Jung-Hoon Kim. Used with permission.
Interpreting Lines

- Lines (solid or dashed) can mean:
  - Edge view of surface
  - Intersection of two surfaces
  - Surface limit

- Dashed lines mean lines “hidden” in current view

- Centerlines are special, have their own symbol
Exercise 3

- Make an isometric sketch of the object depicted in the following orthographic projections.

Courtesy of Martin Culpepper. Used with permission.
Sections

- A cut-away view to reveal detail
  - An imaginary plane (section plane) cuts the object
  - Cut material is cross-hatched

- Section plane is identified
  - Heavy dashed line
  - Arrows
  - Letters
Section Views (“Sections”)

- **Objectives:**
  - Eliminate confusion
  - Aid “readability”

Image from Wikimedia Commons, http://commons.wikimedia.org
Sections

- Section plane may “jog” to show features of interest

Figure by MIT OpenCourseWare.
Partial Sections

- Removed section
- Rotated section

Figure by MIT OpenCourseWare.
Section View Conventions

- **Show all visible edges**

- **Don’t cross-hatch ribs**

Rib in section. Ribs are treated as though the cutting plane were in front of them, to avoid misreading the section as a solid.

Courtesy of Martin Culpepper. Used with permission.

Figure by MIT OpenCourseWare.
Exercise 4

- Sketch (the) three principal views of the following object
END