COLLEGE OF
ENGINEERING, ARCHITECTURE
AND TECHNOLOGY

西南交通大學
Southwest Jiaotong University

INTRODUCTION TO ENGINEERING (ENGR 1111)

Joint Bachelors Degree Program of Oklahoma State University & Southwest Jiaotong University

Dr. M. HASSAN

Title： Associate Professor

INTRODUCTION TO ENGINEERING

COLLEGE OF
ENGINEERING, ARCHITECTURE
AND TECHNOLOGY

Engineering Communication
工程通信

Southwest Jiaotong University

Communication

- Communication is the ability to send & receive messages.
  - People to people •
  - People to machine •
  - Machine to people •
  - Machine to machine

- Communication is an vital part of engineering work.
- Engineers need to communicate their solution to various people.
- Successful engineers have both technical & communication skills.

Importance of Good Communication Skills

- As an engineering student, developing good communication skills is crucial.
- Communicating your solution is as important as the solution itself.
- Without clear communication, the results of your efforts may not be understood and appreciated.
- Engineering often write technical reports containing charts, graphs, & engineering drawings, or brief memorandum or executive summary.

Factors in Professional Communications

- Audience Analysis
  - Is the communication to an expert or a general audience
  - How formal should the communication be
  - What level of detail is expected
  - What is the importance of the communication to the recipient(s)
  - What is the time available for this communication
- Selection of Format to Convey Message
  - Written
    - Email, memoranda, letters, engineering report
  - Oral
    - Telephone calls, informal talk, formal presentations
  - Graphics
    - Drawings, pictures, maps

Factors in Professional Communications

- General Rules
  - The purpose of the communication should be clearly stated at beginning
  - The communication should be direct and to the point
    - Conciseness is necessity
  - Communications have been edited, refined, and practiced, as appropriate
  - Communication should be complete
    - Contains all the required information
  - Select an organizational format appropriate for the communication

Why Are Engineers Often Ineffective Communicators

- Many engineering students have a natural inclination for math & science but little for writing or oral communications
- Engineering students often have little understanding of grammar and basic sentence and paragraph structure

Writing Resources

- **WSU Writing Center**
  - http://www.wright.edu/academics/writingctr/
  - Helps people become more competent writers within a peer tutoring environment
- **WSU Writing Web**
  - http://www.wright.edu/cola/Dept/ENG/wsuwweb/
  - An online community for writers
- **Grammar and Language Information**
  - The Blue Book of Grammar and Punctuation
    - http://www.grammarbook.com/
    - An online reference guide and workbook
  - Grammar, Punctuation, and Capitalization
    - http://www.sti.nasa.gov/publish/sp7084.pdf (free to download)
    - A handbook for technical writers and editors from NASA

Presentation Resources

- **Presentation Skills**
  - http://www.mindtools.com/page8.html (career training website)
  - http://lorien.ncl.ac.uk/ming/dept/Tips/present/present.htm
- **Organization**
  - Toastmasters International
    - A nonprofit educational organization that operates clubs worldwide for the purpose of helping members improve their communication, public speaking and leadership skills
    - http://www.toastmasters.org/
    - Wright State Toastmasters meets at E103 Student Union at 12:00pm on Mondays (brookins.5@wright.edu)

Homework Presentation

Course number	Date due	Assignment number	Last name, first name	1 / 2

Problem number

Number of this sheet

Total number of sheets in the assignment

GIVEN

SKETCH

The purpose of a diagram is to show the given information graphically. By drawing a diagram, you are forced to focus and think about what is given for a problem. On a diagram you want to show useful information such as dimensions, or represent the interaction of whatever it is that you are investigating with its surroundings. Below or along side of the diagram you may list other information that you cannot easily show on the diagram.

FIND

1.
2. *In this block you want to itemize what information you are searching for.*
3.

SOLUTION

SHOW ANY DIAGRAMS THAT MAY COMPLEMENT THE SOLUTION ON THE LEFT-HAND SIDE.

SHOW CALCULATIONS ON RIGHT-HAND SIDE.

List all assumptions. Show completely all steps necessary, in an organized, orderly way, for the solution.

Double underline answers. ← **Answer**

Do not forget about units.

An example of engineering problem presentation.

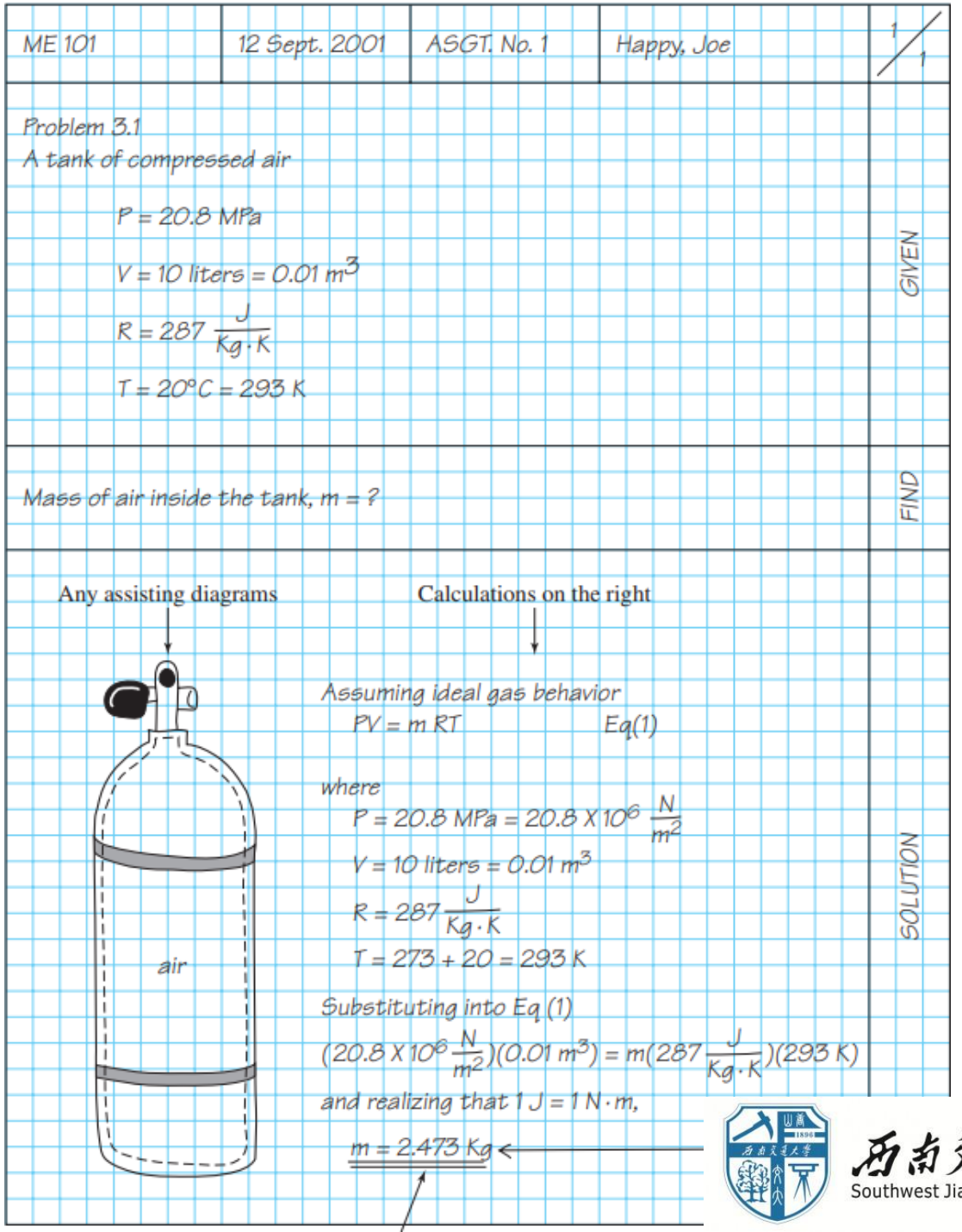
Homework Presentation

Example:

Determine the mass of compressed air in a scuba diving tank, given the following information. The internal volume of the tank is 10 L and the absolute air pressure inside the tank is 20.8 MPa. The temperature of the air inside the tank is 20C. Use the ideal gas law to analyze this problem.

$$PV = mRT$$

An example of engineering homework presentation.



Progress Report, Executive Summary, and Short Memos

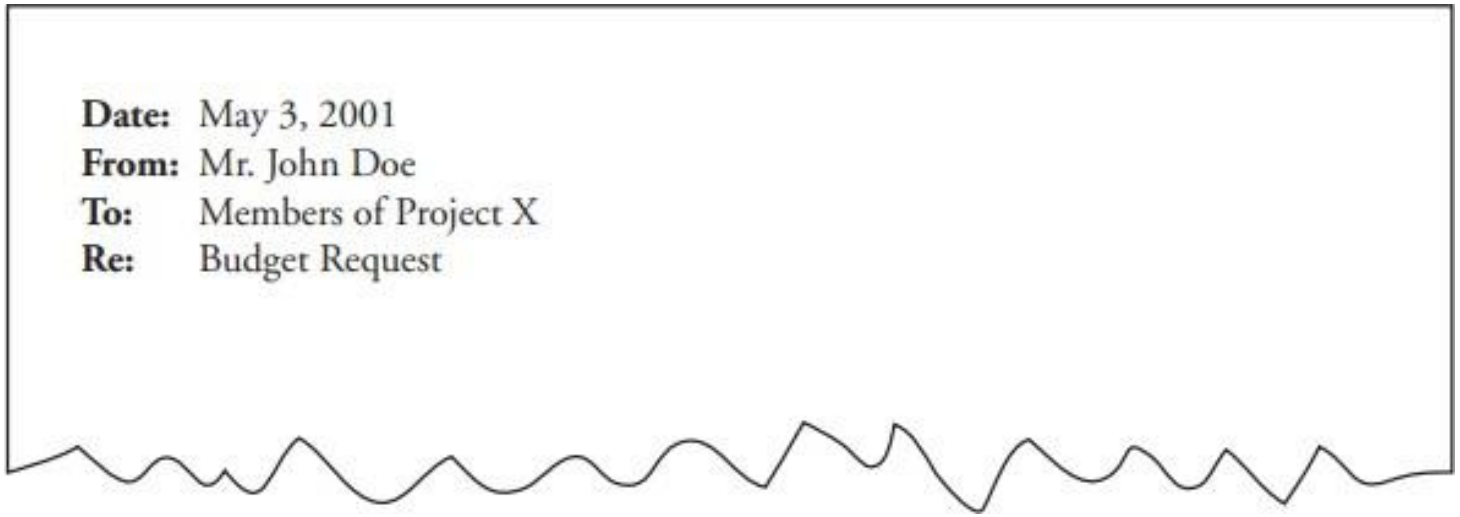
- **Progress Report (进度报告)**
  - Means of communicating to others in an organization or to the sponsors of a project how much progress has been made & which of the main objectives of the project have been achieved to date.
  - Written for a period of a week, a month, several months, or a year.

Progress Report, Executive Summary, and Short Memos

- **Executive Summary (摘要)**
  - Means of communicating to people in top management positions, such as a vice president of a company, the findings of a detailed study or a proposal.
  - Must be brief & concise, generally no more than a few pages long.
  - References may be made to more comprehensive reports so that readers can obtain additional information if they so desire.

Progress Report, Executive Summary, and Short Memos

- **Short Memos (备忘录)**
  - Convey information in a brief way to interested individuals.
  - Under two pages in length



Date: May 3, 2001
From: Mr. John Doe
To: Members of Project X
Re: Budget Request

Detailed Technical Report (详细的技术报告)

- Detailed technical reports dealing with experimental investigations.

Purpose

- Records how and why the work was accomplished and what the results, recommendations, and conclusions were
- Often the only document related to work that is maintained on file for future reference

Detailed Technical Report

- Title
- Abstract → A brief (~200 words or less)
  - Objective(s)
  - Methods(s) used
  - Significant results
  - Conclusions
- Objectives → State what is to be investigated in the experiment
- Theory and Analysis
  - To state pertinent principles, laws, and equations (equations should be numbered);
  - To present analytical models that will be used in the experiment;
  - To define any unfamiliar terms or symbols; and
  - To list important assumptions associated with the experimental design.
- Apparatus and Experimental Procedures
  1. To present a list of apparatus and instrumentation to be used, including the instrument ranges, least count, and identification numbers.
  2. To describe how you performed the experiment. The procedure should be itemized (step 1., 2., etc.) and a schematic or diagram of the instrument setup should be included.
- Data and Results → Present experimental results in a tabular/graphical form
- Discussion of the Results
- Conclusions and Recommendations → Compares the objectives with experimental results
- Appendix
  - To provide the reader with copies of all original data sheets, diagrams, and supplementary notes.
  - To display sample calculations used in processing the data. The sample calculations should contain the following parts:

    A title of the calculation
    A statement of mathematical equation
    Calculation using one sample of data
- References

For Books: Author, title, publisher, place of publication, date (year), and page(s).
For Journal Articles: Author, title of article (enclosed in quotation marks), name of journal, volume number, issue number, year, and page(s).
For Internet Materials: Author, title, date, and URL address.

Detailed Technical Report

ing

Yantai University Trier College of Sustainable Technology

Course Title

Experiment No. _____

Experiment Title _____

_____

_____

Date Experiment Completed _____

Students' Names _____

_____

_____

Oral Communication & Presentation

- Title Slide
  - Title of the presentation
  - To which group, organization or meeting the presentation is being given
  - Presenter's name, affiliation, contact information
  - Date of the presentation
- Outline
  - Outline of the topics to be discussed
- Body
  - Introduction
  - Technical approach
  - Results and discussion
  - Conclusions

Oral Communication & Presentation (Cont....)

- Use of Visual Aids
  - Advantages
    - Catch the audiences' attention
    - Facilitate understanding
  - Disadvantages
    - Preparation time
    - Cost

Engineering Graphical Communication (工程图形通信)

- Engineers use *engineering drawings*, to convey their ideas & design information about products.
- These drawings portray vital information, such as shape of the product, its size, type of material used,& assembly steps.

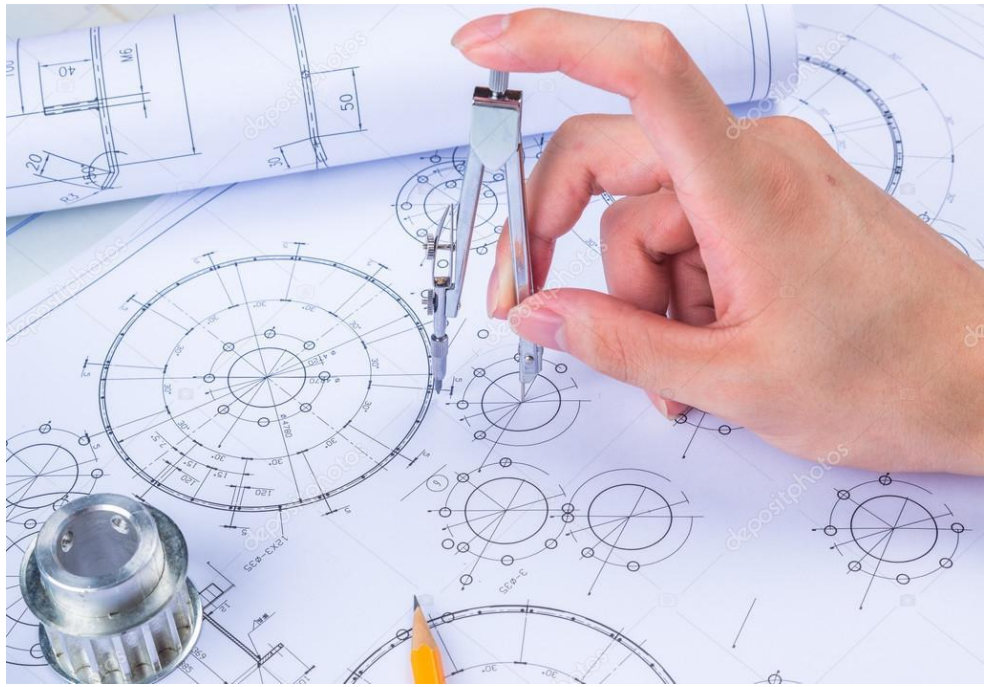
“a picture is worth a thousand words”

- In engineering, a good drawing is worth even more words!
- Engineering drawings are important in conveying useful information to other engineers or machinists

Engineering drawings

1. Hand Sketch

- During the idea-generation phase, hand sketches can be extremely useful.
- By quickly drawing things on paper, an engineer can rapidly convey a design concept to other team members.
- Hand sketches also are the method of choice for entering ideas into engineering logbooks.



2. Orthographic view (正交图)

- ***Orthographic view*** of an object shows *two-dimensional (2D)* version of its front, side & top views.
- Exceptionally easy to draw but require more interpretation to read the drawing
- three different types of lines are used to describe the object: *solid lines*, *dashed lines*, & *centerlines*.
  - *Solid lines* represent the visible edges of planes or the intersection of two planes.
  - *Dashed lines* represent the intersection of two planes that are not visible from the direction you are looking.
  - *Centerline* shows where the center of holes or the center of cylinders are.

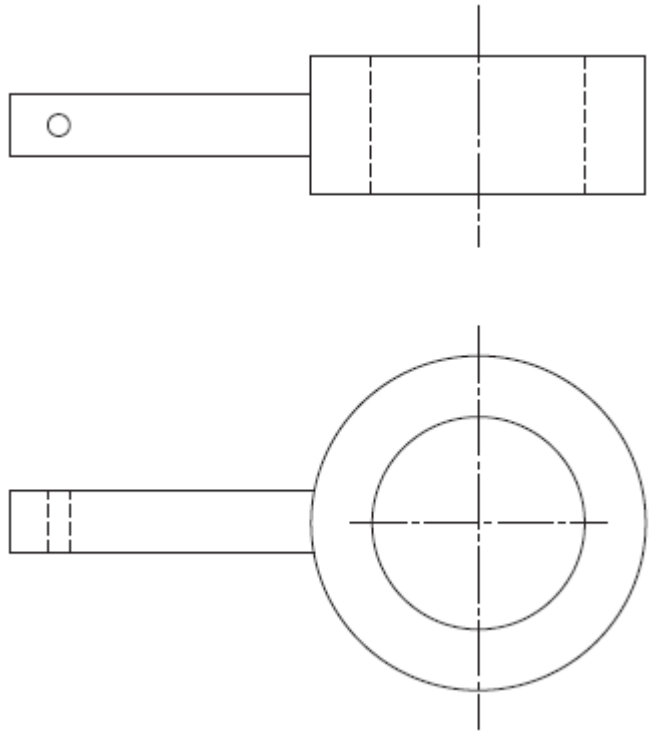
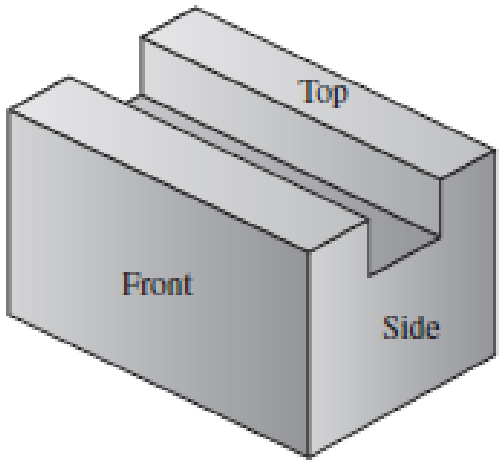


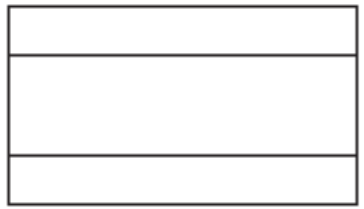
Fig: The orthographic projection of an object.

Example of **Orthographic view**

Draw the orthographic views of the object shown in *Figure (a)*

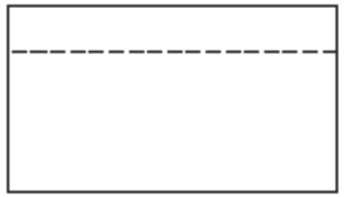


(a)



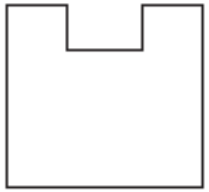
(b)

the top view



(c)

the front view

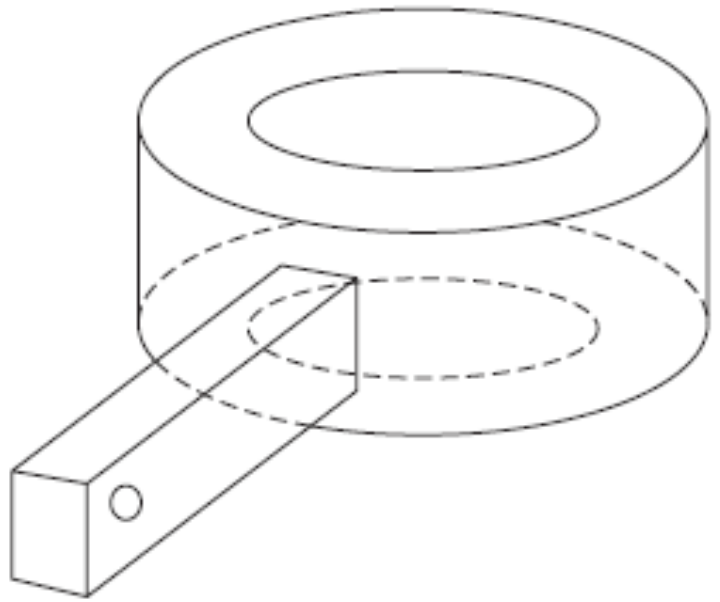


(d)

the side view

3. Isometric view (等轴测图)

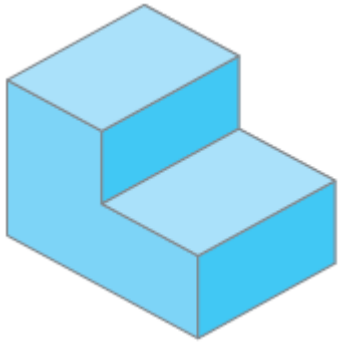
- When it is difficult to visualize an object using only its orthographic views, an isometric sketch is also drawn.
- It shows the 3D version of an object in a single view.
- It provides a “birds-eye view” of the object that conveys many of its features at a single glance.
- Easier to draw



Isometric view of cylindrical collar with rectangular tab & pin hole.

Isometric diagram (Cont….)

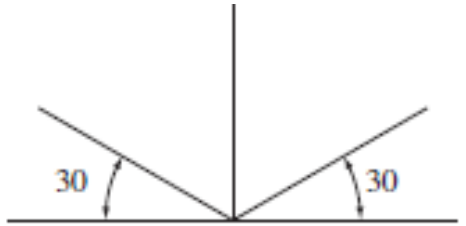
Draw isometric diagram of the object shown in the Figure



Steps in creating an isometric diagram

Step 1: Draw the width, height, & depth axes.

- Width & depth axis form a 30 angle with a horizontal line.
- Height axis makes a 90 angle with a horizontal line & a 60 angle with each of the depth & width axes.

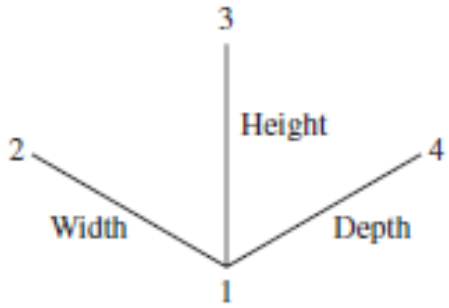


Step 1
(a)

(1) Create the isometric axes & grid

Step 2: Measure & draw the total width, height, & depth of the object.

- Hence, draw lines 1–2, 1–3, & 1– 4.



Step 2
(b)

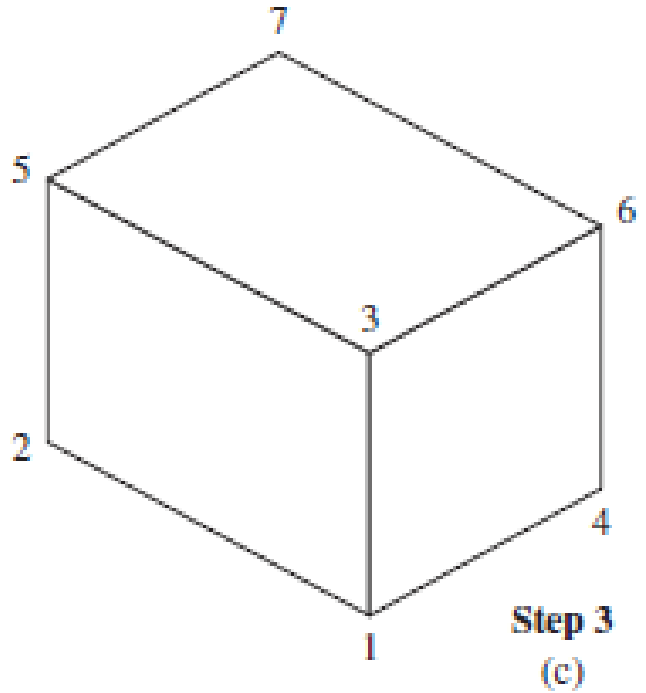
(2) mark the height, width, & depth of the object on the isometric grid

Isometric diagram (Cont….)

Steps in creating an isometric diagram

Step 3: Create the front, the top, & the side work faces.

Draw line 2–5 parallel to line 1–3;
draw line 4 –6 parallel to line 1–3;
draw line 3–5 parallel to line 1–2;
draw line 3–6 parallel to line 1– 4;
draw line 5–7 parallel to line 3–6; &
draw line 6 –7 parallel to line 3–5.



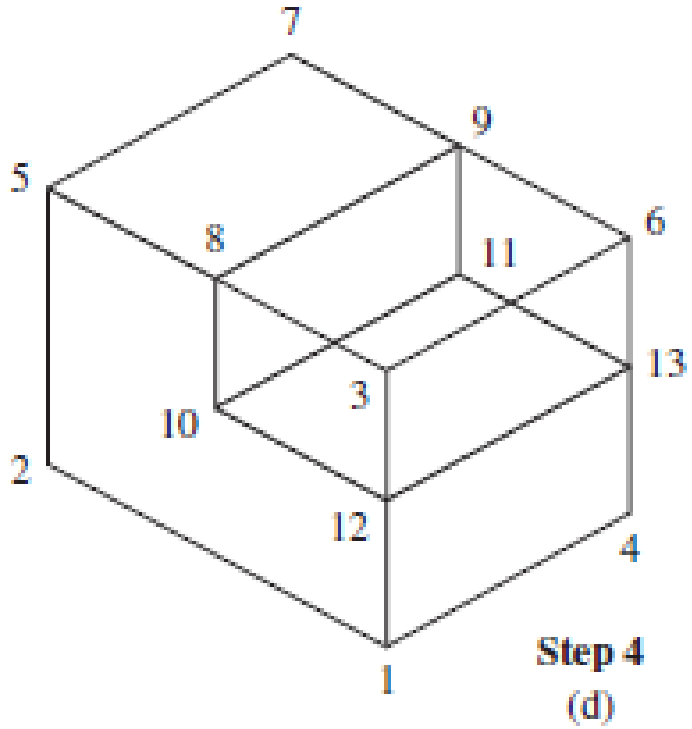
(3) create the front, the top, & the side work faces

Isometric diagram (Cont….)

Steps in creating an isometric diagram

Step 4: Complete the drawing as marked by the remaining line numbers.

- Remove the unwanted lines 3–6, 3–8, 3 –12, 6 –13, & 6 –9

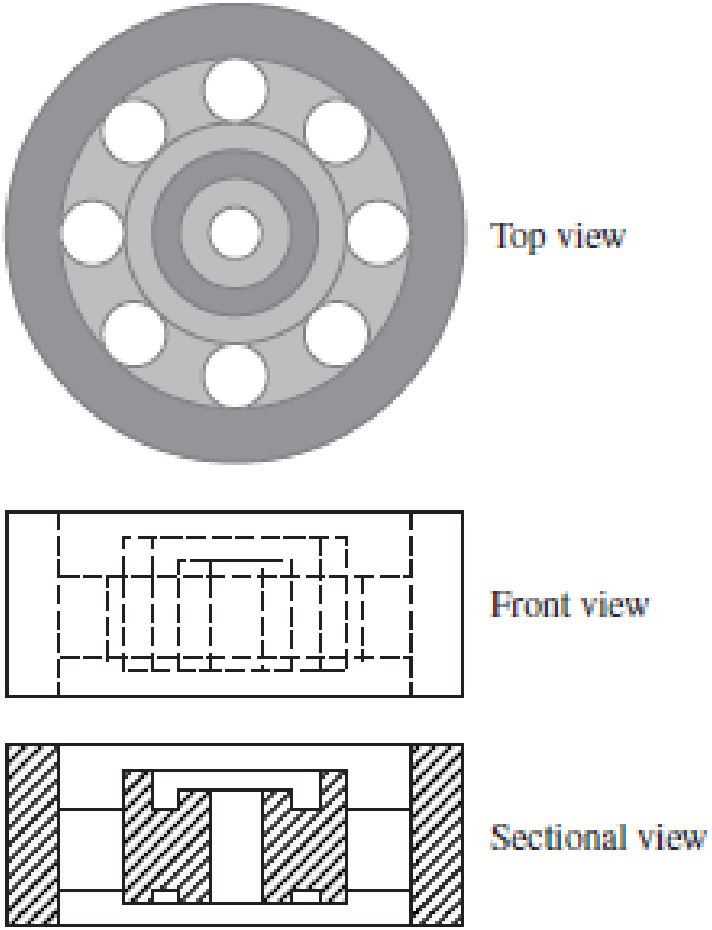


(4) complete the drawing.

4. Sectional diagrams (剖面图)

Sectional diagrams

- Used for objects with complex interiors.
- Reveal the inside of the object.
- Drawn to show clearly the solid portions & the voids within the object.



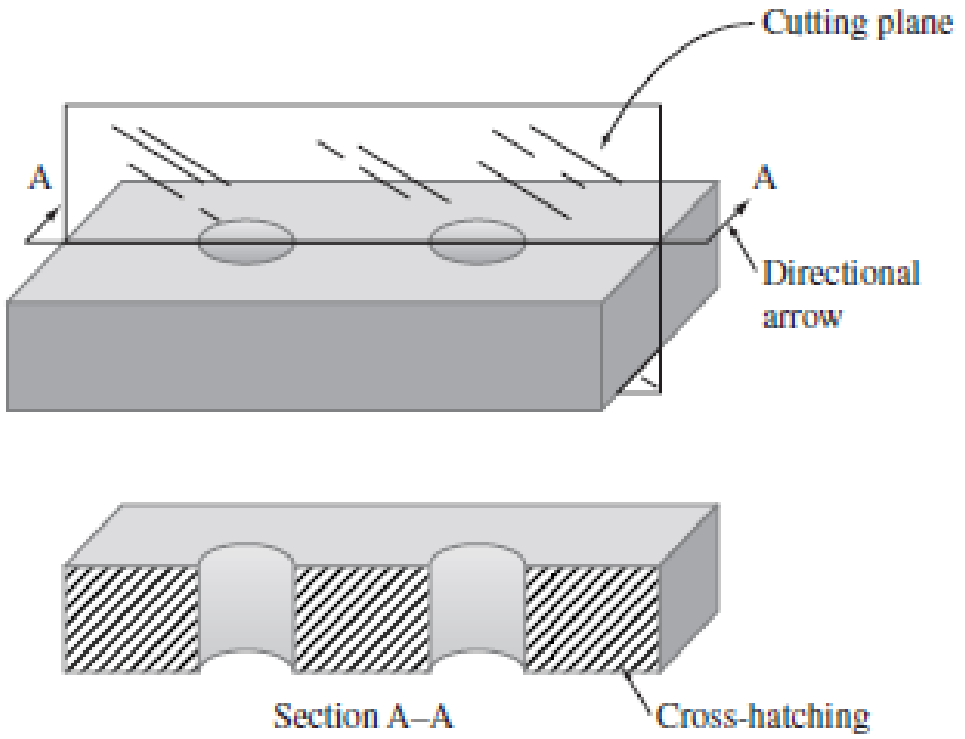
An object with a complex interior

Sectional diagrams (剖面图) Cont.....

Steps in creating a Sectional diagram

Step 1: defining the cutting plane & direction of the sight.

- The direction of the sight is marked using directional arrows
- Use of identifying letters with the directional arrows to name the section



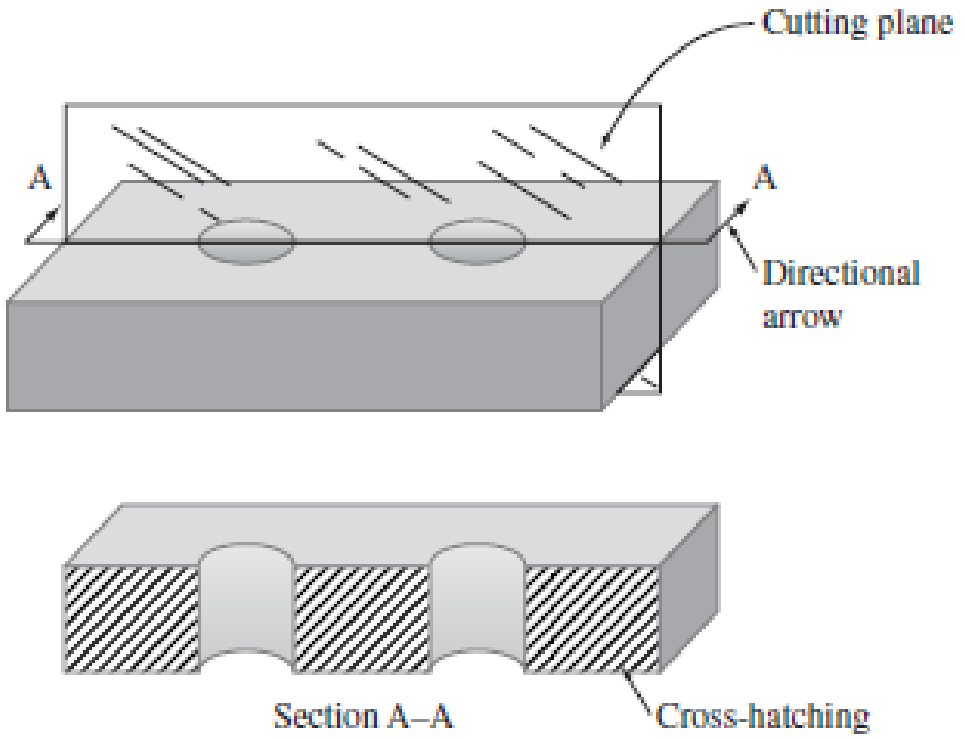
A sectional view of an object

Sectional diagrams (剖面图) Cont.....

Steps in creating a Sectional diagram

Step 2: Identifying & showing on the sectional diagram which portion of the object is made of solid material & which portion has the voids.

- Solid section of the diagram is then marked by parallel inclined lines.
- This method of marking the solid portion of the diagram is called *cross-hatching*.



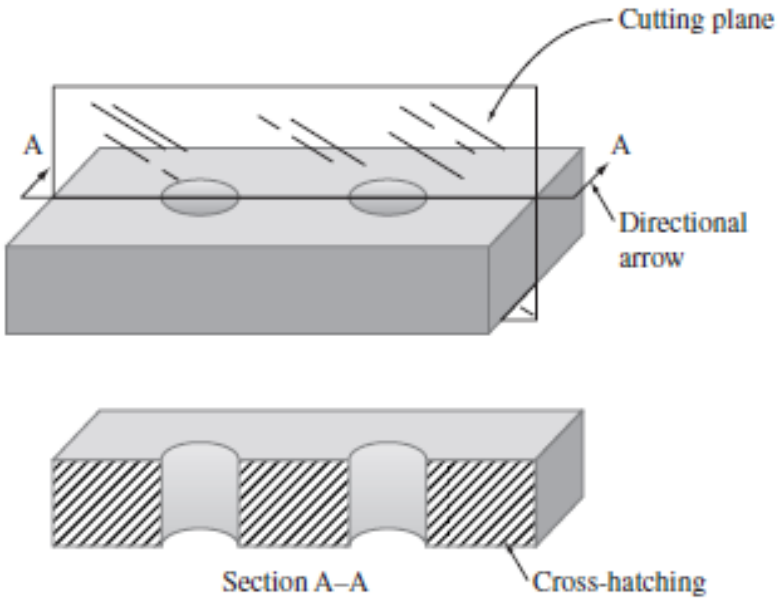
A sectional view of an object

Sectional diagrams (剖面图) Cont.....

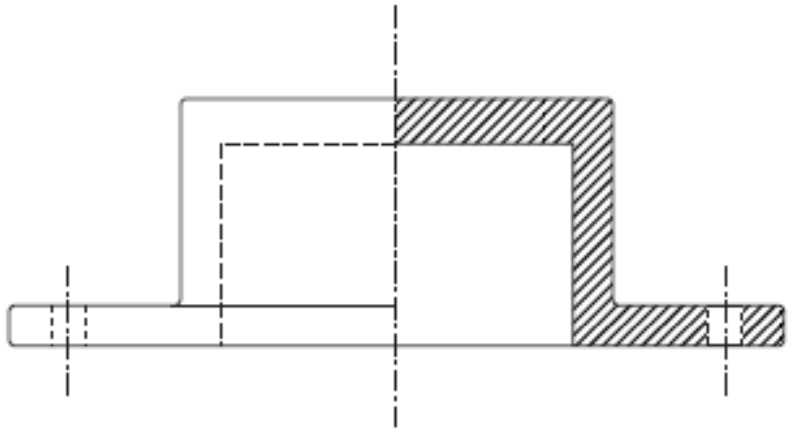
Types of sectional diagrams

- *Full-sectional diagram* are created when the cutting plane passes through the object completely.

- *Half-sectional diagrams* are used for symmetrical (对称) objects.
  - For such objects, half of the object is drawn in sectional view & other half as exterior view.
  - *Advantage:* They show interior & exterior of the object using one view.



An example of full-sectional view

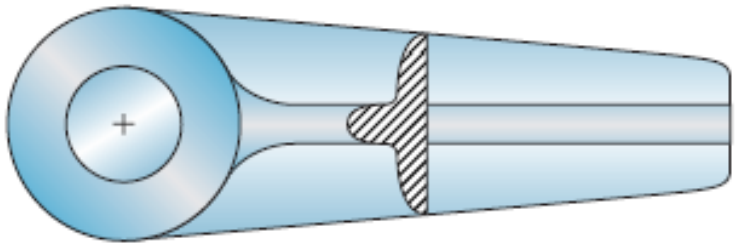


An example of half-sectional view

Sectional diagrams (剖面图) Cont.....

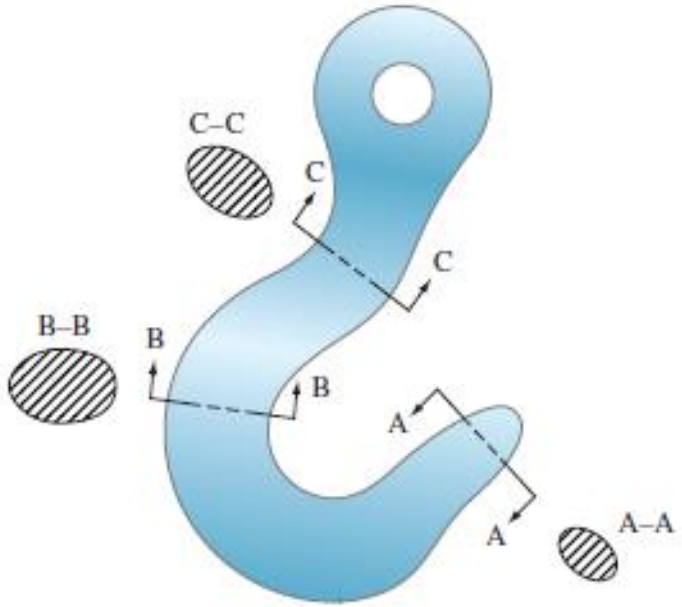
Types of sectional diagrams

- *Rotated section diagram* are when the object has uniform cross-section with a shape that is difficult to visualize.
  - Cross section is rotated by 90 & is shown in the plane of view.



An example of rotated section view

- *Removed sections* are similar to rotated sections, except instead of drawing the rotated view the view itself, removed sections are shown adjacent to the view.
  - Cutting planes must be properly marked.



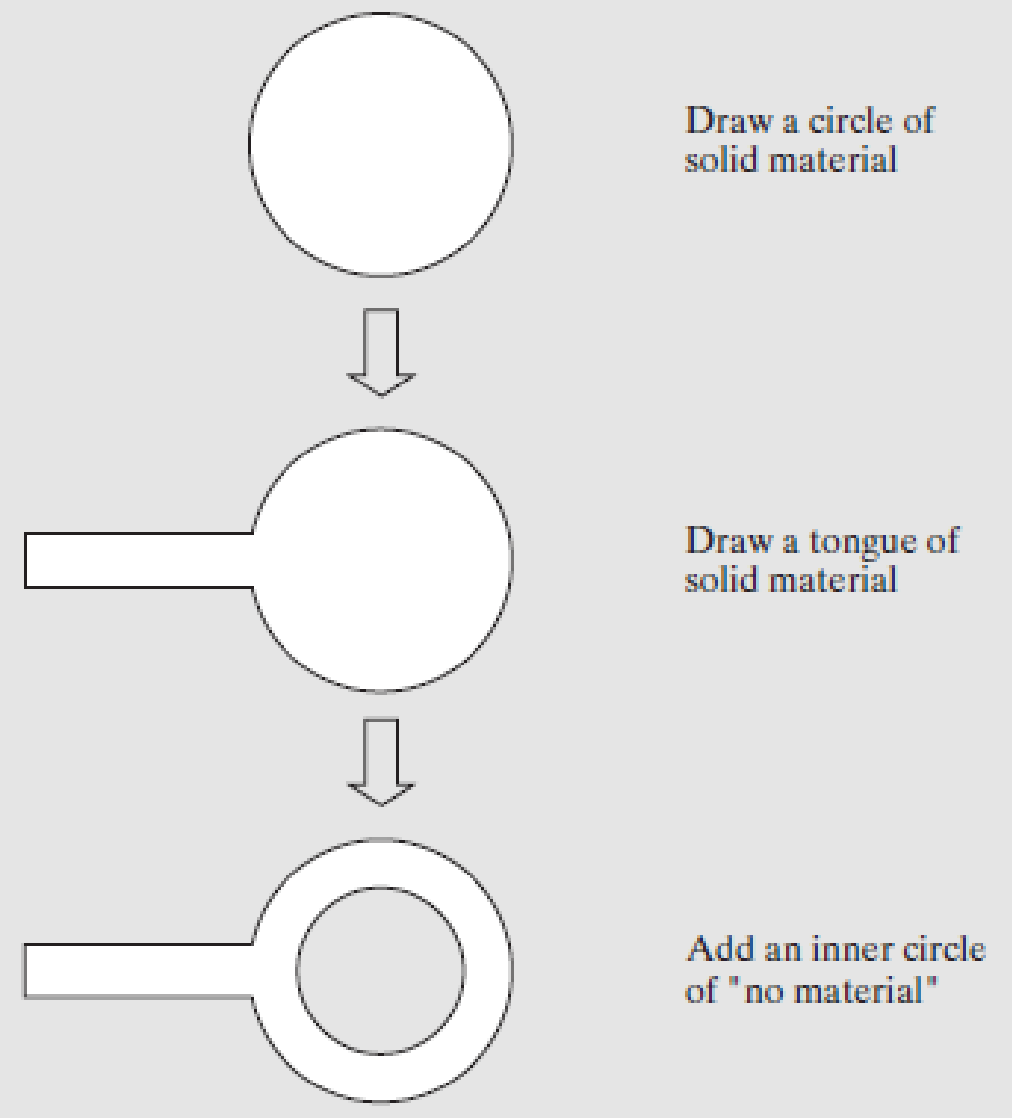
An example of removed section view

5. Solid model

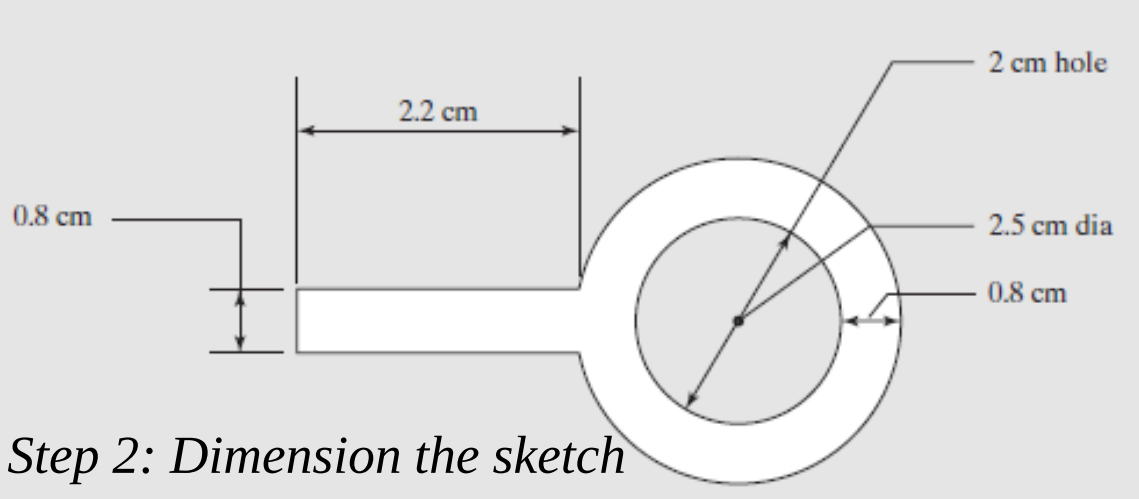
The most computationally sophisticated type of drawing

- *Isometric* & *orthographic* projections, depict just the surfaces of an object.
- A solid model contains a complete mathematical description of the object's material properties as well as its interior & exterior dimensions.
- *Advantage:*
  - It can be used to predict the object's deformation under applied stress, its reaction to temperature changes, & its interaction with other parts in the system.
  - It allows the user to view an object's hidden features, as well as view the object as its rotation is simulated.

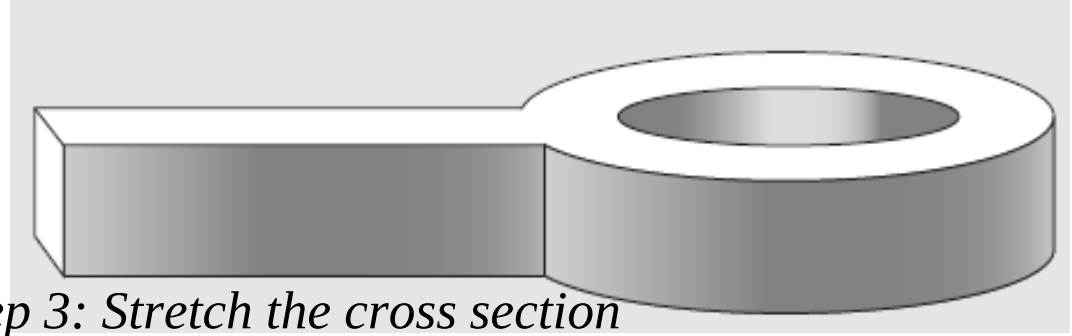
Solid model



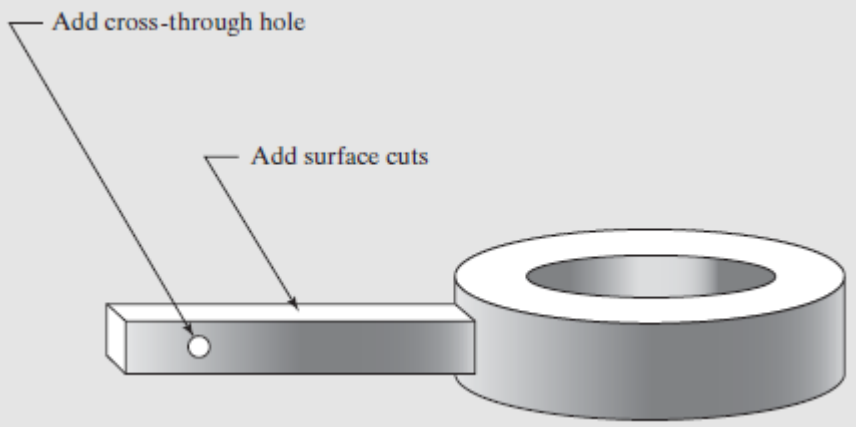
Step 1: Sketch the principal cross section



Step 2: Dimension the sketch

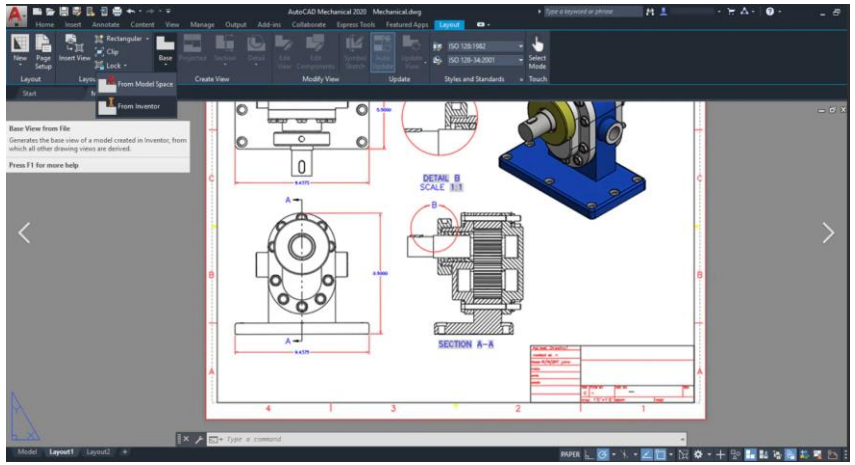


Step 3: Stretch the cross section

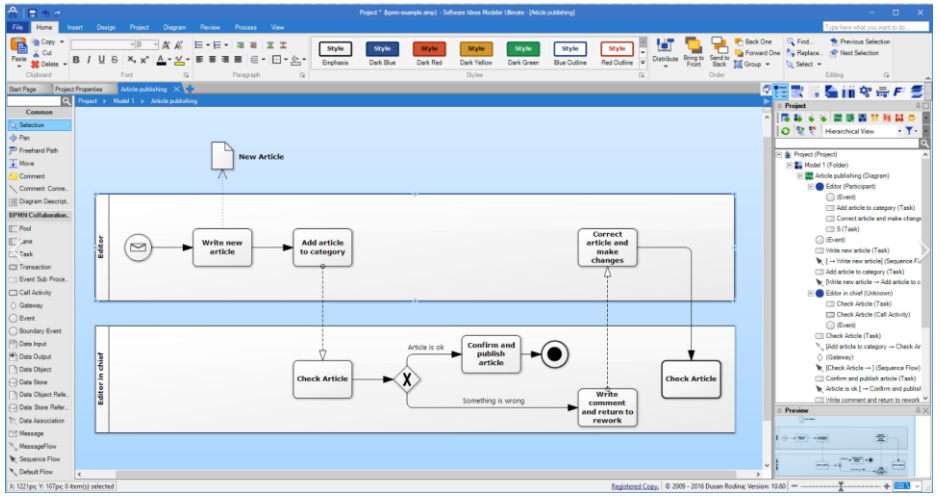


Step 4: Add features to the stretched part

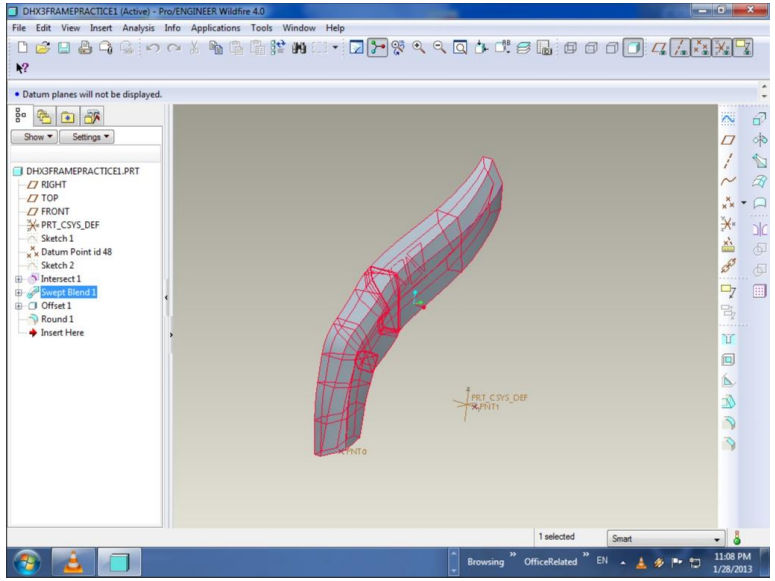
Solid modeling software



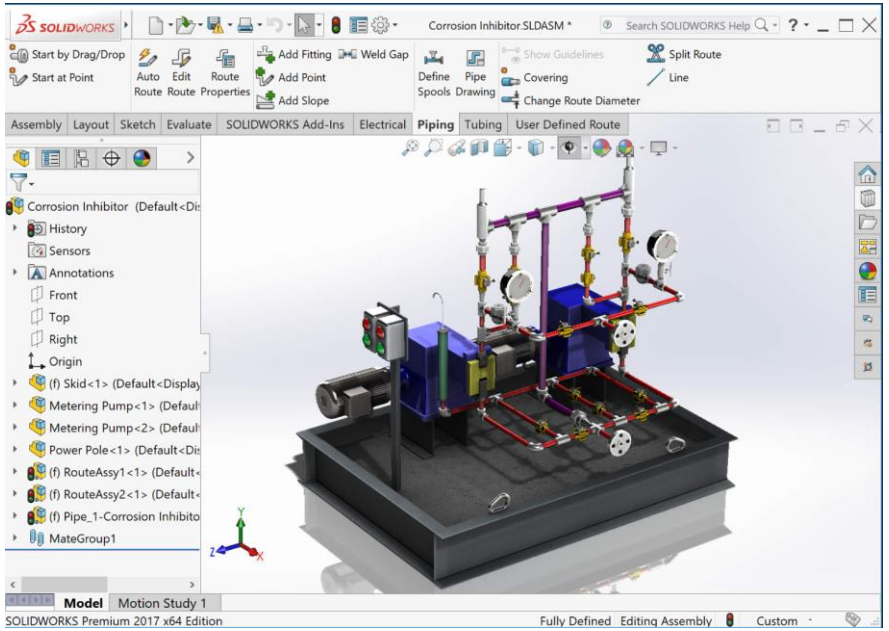
- AutoCAD



- IDEAS



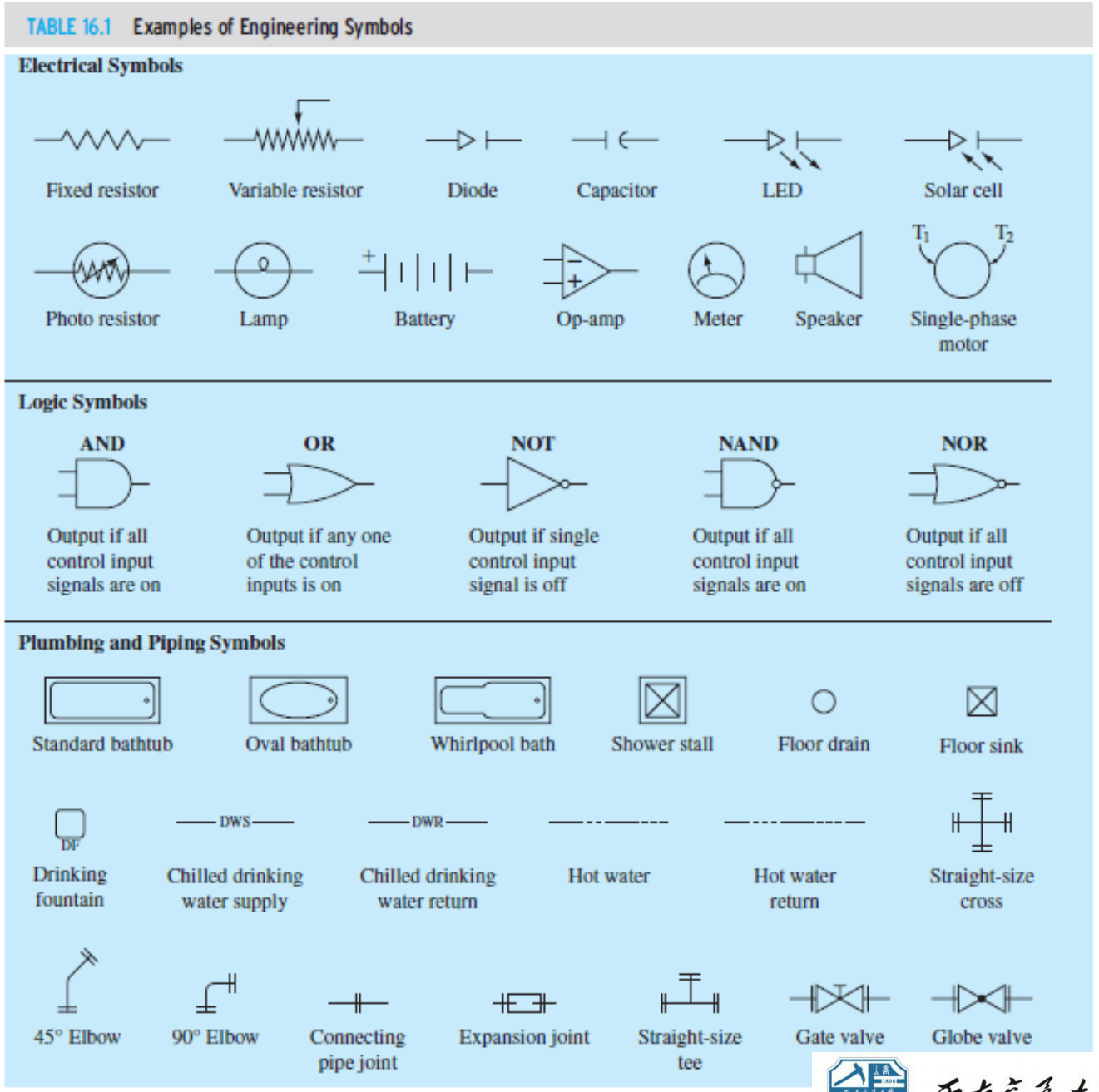
- Pro-Engineer



- SolidWorks

Engineering Symbols

- A means to convey information & to effectively communicate to other engineers.



COLLEGE OF
ENGINEERING, ARCHITECTURE
AND TECHNOLOGY

西南交通大學
Southwest Jiaotong University

Thank you