



Lesson 2.3 – Advanced Modeling Skills

Concepts

1. Solid modeling programs allow the designer to create quality designs for production in far less time than traditional design methods.
2. Engineers use CAD models, assemblies, and animations to check for design problems, verify the functional qualities of a design, and communicate information to other professionals and clients.
3. Auxiliary views allow the engineer to communicate information about an object's inclined surfaces that appear foreshortened in basic multiview drawings.
4. Designers use sectional views to communicate an object's interior features that may be difficult to visualize from the outside.
5. As individual objects are assembled together, their degrees of freedom are systematically removed.
6. Engineers create mathematical formulas to establish geometric and functional relationships within their designs.
7. A title block provides the engineer and manufacturer with important information about an object and its creator.
8. A parts list and balloons are used to identify individual components in an assembly drawing.

Performance Objectives

It is expected that students will:

- Sketch and model an auxiliary view of a given object to communicate the true size and shape of its inclined surface.
- Describe the purpose and demonstrate the application of section lines and cutting plane lines in a section view drawing.
- Sketch a full and half section view of a given object to communicate its interior features.
- Identify algebraic relationships between the dimensional values of a given object.
- Apply assembly constraints to individual CAD models to create mechanical systems.
- Perform part manipulation during the creation of an assembly model.
- Explain how assembly constraints are used to systematically remove the degrees of freedom for a set of components in a given assembly.
- Create an exploded model of a given assembly.
- Determine ratios and apply algebraic formulas to animate multiple parts within an assembly model.

- Create and describe the purpose of the following items: exploded isometric assembly view, balloons, and parts list.

Essential Questions

1. What are the six degrees of freedom that an object has in space?
2. How do assembly constraints differ from geometric and numeric constraints?
3. What is the difference between an assembly and a subassembly?
4. For what reason might an engineer need to create an auxiliary view of an object?
5. For what reason might an engineer need to create a section view of an object?
6. What is a title block?
7. What information is typically on a title block?
8. What is an assembly drawing?
9. What purpose do balloons and a parts list serve in an assembly drawing?
10. What kind of information may be included in a parts list?

Key Terms

Assembly	Assembly Drawing	Auxiliary View
Balloons	Blind Hole	Break Line
Broken-Out Section	Chamfer	Clearance Fit
Component	Constraint	Counterbore
Countersink	Cutting Plane Line	Degree of Freedom
Detail Drawing	Documentation	Exploded Assembly
Fillet	Foreshorten	Formula
Full Section	Half Section	Interference
Key	Keyseat	Keyway
Parameter	Parametric modeling	Parts List
Phantom Line	Ratio	Rib
Rotation	Round	Scale
Section Lines	Sectional View	Spotface
Subassembly	Tap	Taper
Title Block	Translation	Working drawings

Instructional Resources

PowerPoint presentations

Work Points, Work Axes, and Work Planes

Parametric Modeling

Auxiliary Views

Sectional Views

Basic Assembly Constraints and Concepts

Exploded CAD Assembly Models

Animating Assembly Models and Exporting Video

Assembly Drawings, Balloons, and Parts List

Word Documents

Project 2.3.1 Arbor Press

Project 2.3.1a Miniature Train

Activity 2.3.2 Parametric Constraints

Activity 2.3.3 Auxiliary Views

Activity 2.3.4 Sectional Views

Activity 2.3.5 Assembly Models

Activity 2.3.6 Arbor Press Drawings

Activity 2.3.6 Detail Drawing Rubric

Lesson 2.3 Key Terms and definitions in Excel

Reference Sources

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Note: Additional resources pertaining to CAD solid modeling are available on the Project Lead The Way, Inc. Virtual Academy.