Week 4 - Lecture
Assemblies
Lecture Topics

• Assemblies and Product Structure
• Bill of Materials
• PLM Role and Definition
• Design for Assembly Overview
• Case Study Examples
Product Lifecycle – Week 4

Requirements Management
Portfolio Management
Conceptual Design
Product Engineering
Manufacturing Engineering
Simulation & Validation
Build & Produce
Disposal & Recycling
Maintenance & Repair
Sales & Distribution
Test & Quality
What is an Assembly

• Digital prototype of actual product consisting of parts and sub-assemblies.
Terms

• Bill of Material (BOM)
  – Master list of items and their quantities to assemble a product

• Engineering Bill of Material (EBOM)
  – Reflects the product as it is designed by engineering

• Manufacturing Bill of Material (MBOM)
  – Focuses on the items needed to manufacture a product

• Product Structure
  – The hierarchical structure of a product
Difference Between EBOM and MBOM

EBOM

MBOM
Product Architecture

• Determining your product architecture and structure is critical for product configuration and concurrent engineering.
Bill of Material (BOM)
Product Structure

File versions for each type of file related.

Attribute Values
- Part Name
- Part Number
- Manufacturer Number

Data Set Files
- 3D Models
- Drawings
- Requirements
- Viewable File

Related Data
- Manufacturing Data
- Tooling Data
- Costing Data
- Change Orders
Concurrent Engineering

- Concurrent engineering is the approach to having multiple people or groups working together at the same time on a product.
Notes on Concurrent Engineering

• In all cases only one person can work on a part or assembly at the same time. This impacts concurrent design. This is also true for design responsibility.
Assembly Structure Tips

• Establish the sub-assemblies and parts just like you would assemble the real product.

• To ensure the most optimal reuse, group items into logical sets for standardization.
Assembly Creation Methods

Bottom-Up

Top-Down
Bill of Materials Example

Product

<table>
<thead>
<tr>
<th>Item</th>
<th>Qty.</th>
<th>Part #</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>10001</td>
<td>Motor Assembly</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>10002</td>
<td>Stop Block</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>Item</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>20001</td>
<td>Shaft</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>20002</td>
<td>Bearing</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>20003</td>
<td>Case</td>
</tr>
</tbody>
</table>
Product Lifecycle Management

- **Product Lifecycle Management (PLM)**

- PLM is a business approach to solving the problem of managing product definition information.

- PLM is not a definition of technology.

Source: CIMdata www.cimdata.com
PLM Definition

• A strategic business approach that applies a consistent set of business solutions that support the collaborative creation, management, dissemination, and use of product definition information.

• Supporting the extended enterprise (customers, design and supply partners, etc.)

• Spanning from concept to end of life of a product.

• Integrating people, processes, business systems, and information.

Source: CIMdata www.cimdata.com
PLM Think tank http://plmtwine.com
PLM Primary Functions

Data Vault & Document Management

Data Authoring (CAx)

Workflow & Process Management

Classification Management

Structure Management

Program & Project Management

Source: CIMdata www.cimdata.com
PLM Summary

- PLM manages the complex and complete product definition.
Product Data Management

• Product Data Management (PDM) is the system that is used for the managing and tracking of product design data primarily focused around engineering.

• Product Data Management (PDM) is often one element of an overall PLM strategy.
ERP Role

• The PLM system most commonly integrates with the ERP business system.

• The ERP manages the physical item information of a product.

• The Bill of Material information is most commonly linked between PLM and ERP.

Design for Assembly (DFA)

• Design for Assembly (DFA) is the proactive approach to designing a product for ease of assembly to reduce cost and time.
Design for Assembly Example

- 3 Parts
- Requires a screwdriver
- Needs careful alignment
- Time Consuming

- 3 Parts
- Requires a rivet gun
- Alignment not as delicate
- Assembly Time Less

- 2 Parts
- Integrated Fastener
- Requires machine to secure the head of the fastener

- 2 Parts
- Integrated Fastener
- Can be hand pressed into place and removed
Computer-Cluster Projects (CP3)
Cluster Project 1

• Guides instructions for learning general assembly constraints.
Cluster Project 2

• Guided instructions for assembly visualization and manipulation.
Cluster Project 3

- Guided instructions for designing in the assembly context (Top Down).
Problem Set Assignment

- Problem set assignment for assembling the lower seat frame assembly.
Assemblies
Demo Topics
About Project Files

1. Assemblies reference parts
2. Drawings reference parts.
3. Drawings reference assemblies.
4. Drawings reference presentations.
5. Presentations reference assemblies
Project File Configuration

• Projects Dialog Box
  – Used to create, edit, or set a project current.
  – Top pane shows the available projects, and the lower pane shows the settings and configured options for the selected project.
Assembly Constraints

- **Mate/Flush Constraint**
  - The Mate/Flush constraint is used to align part features such as faces, edges, or axis.

- **Before Mate Constraint**
  - After Mate Constraint

- **Before Flush Constraint**
  - After Flush Constraint
Assembly Constraints

• **Angle Constraint**
  - Used to specify an angle between two parts. The angle constraint is applied to faces, edges, or axes.

• **Before Angle Constraint**  **After Angle Constraint**
Assembly Constraints

- **Tangent Constraint**
  - Used to define a tangential relationship between two parts. The tangent constraint is generally applied to circular faces and planar faces. One of the selected faces must be circular.

- **Before Tangent Constraint**
  - **After Tangent Constraint**
Assembly Constraints

• **Insert Constraint**
  - This constraint is used to insert one component into another. This constraint effectively combines a mate axis/axis and a mate face/face constraint. Generally the insert constraint is applied to bolts, or pins, or any part that needs to be inserted into a hole on another part. It is applied by selecting a circular edge on each part.

• **Before Insert Constraint**
  ![Before Insert Constraint](image1)

• **After Insert Constraint**
  ![After Insert Constraint](image2)
Isolating Components

- **Isolate**
  
  **Isolate**: Overflow Menu: Right-click a selected component > Isolate

- **Undo Isolate**
  
  **Undo Isolate**: Overflow Menu: Right-click in the browser or graphics window > Undo Isolate.
Find in Browser

- **Find In Browser**

Overflow Menu: Right-click a selected component in the graphics window.
Zoom Selected

- **Find in Window, Zoom Selected**
  
  Ribbon: View tab > Navigate panel

- Keyboard: **END**

Overflow Menu: Right-click a selected component in the browser.
Selecting Components

• Selection Filters

Quick Access Toolbar: Component Priority Flyout > Select

Keyboard: SHIFT+right-click
Sections

- Assembly Sections

Ribbon: View tab > Appearance panel

Half-section view:  Quarter-section view:  Three-quarter section view:
Designing components in-place

- **Create Components in Context**
  - Design each component while still in the assembly environment.
  - As you design each component, you are applying the required assembly constraints, and are making changes to parts based upon their relationships to other components in the assembly.
Checking for Interferences

- Interference

Ribbon: Inspect tab > Interference panel > Analyze Interference
Driving Constraints for Simple Motion and Analysis

- **Drive Constraint**

  RMB on the constraint in the browser > **Drive Constraint**
Placing Standard Components Using the Content Center

- Content Center

Ribbon: **Assemble** tab > **Component** panel > **Place from Content Center**