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Autodesk® Inventor® 2023 Advanced Assembly Modeling

Learning Guide

Mixed Units - 1st Edition

AUTODESK
Authorized Publisher

ASCENT - Center for Technical Knowledge®
Autodesk® Inventor® 2023
Advanced Assembly Modeling

Mixed Units - 1st Edition

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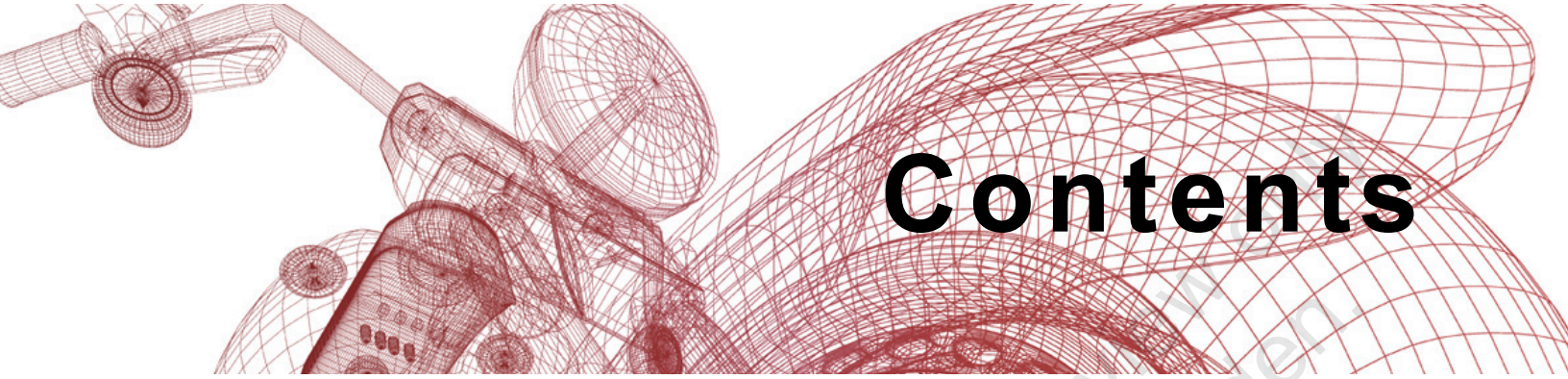

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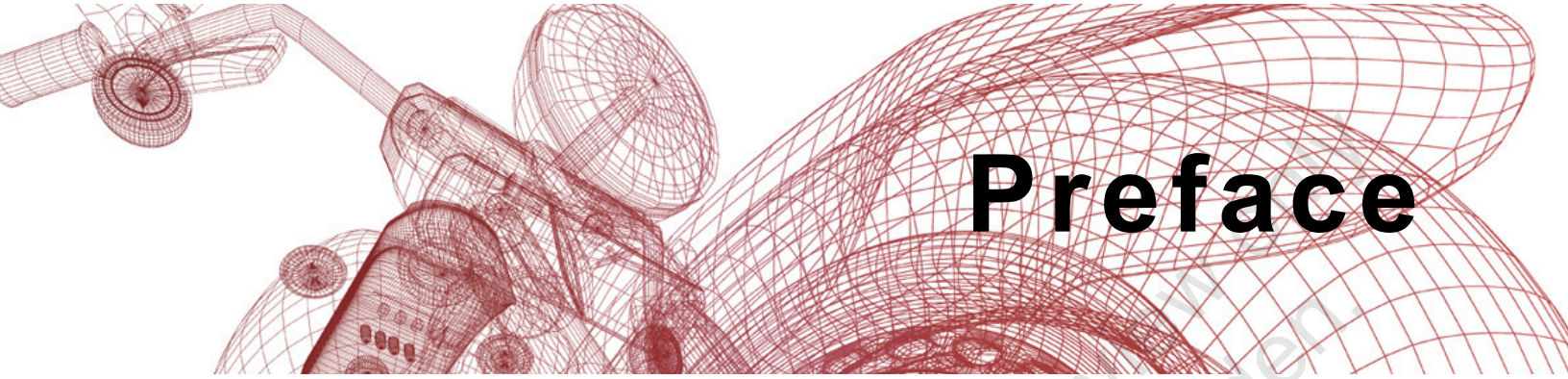

Preface

The *Autodesk® Inventor® 2023: Advanced Assembly Modeling* guide builds on the skills acquired in the *Autodesk Inventor 2023: Introduction to Solid Modeling* and *Autodesk Inventor 2023: Advanced Part Modeling* guides to take you to a higher level of productivity when creating and working with assemblies.

You begin by focusing on the Top-Down Design workflow. You learn how tools are used to achieve this workflow using Derive, Multi-Body Design, and Layouts. Other topics include model simplification tools, positional representations, model states, iMates and iAssemblies, Frame Generator, Design Accelerator, and file management and duplication techniques. A chapter that explains how to render, produce, and animate realistic images in Autodesk® Inventor® Studio has also been included.

Topics Covered

- Applying motion to existing assembly constraints using Motion and Transitional constraints.
- Introduction of the Top-Down Design technique for creating assemblies and their components.
- Tools for Top-Down Design, such as associative links, adaptive parts, multi-body and layout design, derived components, and skeleton models.
- Creating positional representations to review motion, evaluate the position of assembly components, or document an assembly in a drawing.
- Using the model simplification tools to create simplified part models and views of assembly designs.
- Creating model states and iAssemblies to create customizable versions of assembly designs.
- Creating rendered realistic images and animations of parts and assemblies using Autodesk Inventor Studio and the Video Producer.
- Using the Design Accelerator and Frame Generator to easily insert standard and customizable components and features into your model.
- Efficiently duplicating components in an assembly.
- Adding welds and weld symbols to weldment assemblies.

Prerequisites

- Access to the 2023.0 version of the software, to ensure compatibility with this guide. Future software updates that are released by Autodesk may include changes that are not reflected in this guide. The practices and files included with this guide are not compatible with prior versions (e.g., 2022).
- The class assumes mastery of Autodesk Inventor basics as taught in *Autodesk® Inventor®: Introduction to Solid Modeling*. In addition, *Autodesk® Inventor®: Advanced Part Modeling* knowledge is recommended.
- The use of Microsoft® Excel is required for this training course.

Note on Software Setup

This guide was written for the 2023.0 release of the Autodesk Inventor software. Future software updates that may be released by Autodesk may incorporate changes to workflows that will not be reflected in this guide. This guide assumes a standard installation of the software using the default preferences during installation. Lectures and practices use the standard software templates and default options for the Content Libraries.

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With a dedication for engineering and education, Jennifer has spent over 25 years at ASCENT managing courseware development for various CAD products. Trained in Instructional Design, Jennifer uses her skills to develop instructor-led and web-based training products as well as knowledge profiling tools.

Jennifer has achieved the Autodesk Certified Professional certification for Inventor and is also recognized as an Autodesk Certified Instructor (ACI). She enjoys teaching the training courses that she authors and is also very skilled in providing technical support to end-users.

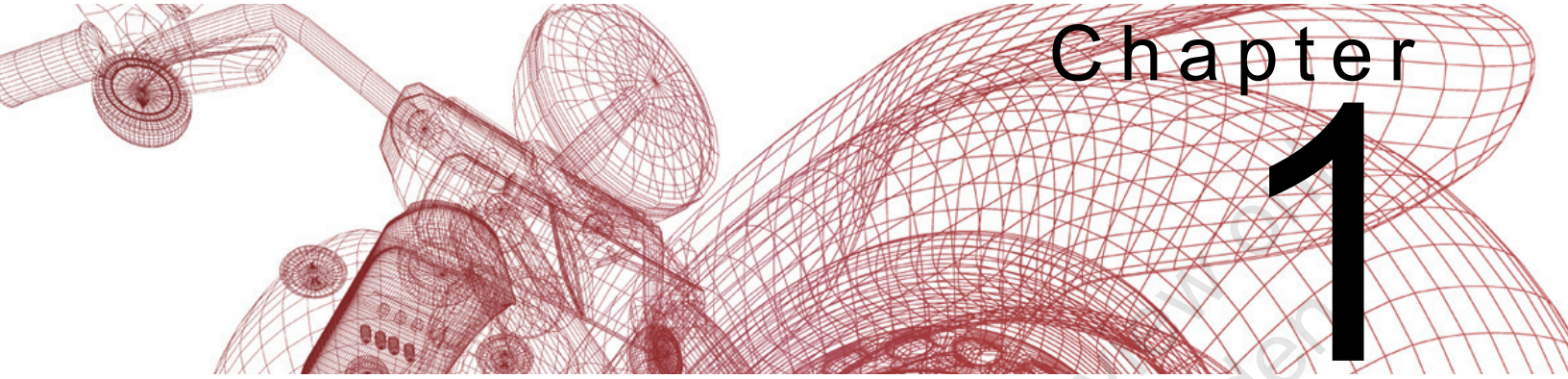
Jennifer holds a Bachelor of Engineering Degree as well as a Bachelor of Science in Mathematics from Dalhousie University, Nova Scotia, Canada.

Jennifer MacMillan has been the Lead Contributor for *Autodesk Inventor: Advanced Assembly Modeling* since 2007.

In This Guide

The following highlights the key features of this guide.

Feature	Description
Practice Files	The Practice Files page includes a link to the practice files and instructions on how to download and install them. The practice files are required to complete the practices in this guide.
Chapters	A chapter consists of the following: Learning Objectives, Instructional Content, Practices, Chapter Review Questions, and Command Summary. • **Learning Objectives** define the skills you can acquire by learning the content provided in the chapter. • **Instructional Content**, which begins right after Learning Objectives, refers to the descriptive and procedural information related to various topics. Each main topic introduces a product feature, discusses various aspects of that feature, and provides step-by-step procedures on how to use that feature. Where relevant, examples, figures, helpful hints, and notes are provided. • **Practice** for a topic follows the instructional content. Practices enable you to use the software to perform a hands-on review of a topic. It is required that you download the practice files (using the link found on the Practice Files page) prior to starting the first practice. • **Chapter Review Questions**, located close to the end of a chapter, enable you to test your knowledge of the key concepts discussed in the chapter. • **Command Summary** concludes a chapter. It contains a list of the software commands that are used throughout the chapter and provides information on where the command can be found in the software.
Appendices	Appendices provide additional information to the main course content. It could be in the form of instructional content, practices, tables, projects, or skills assessment.



Chapter 1

Advanced Assembly Tools

The use of Motion and Transitional constraints provides added flexibility in constraining components and allowing motion between them. This chapter discusses the motion constraint, as well as a number of additional miscellaneous assembly tools available in the Autodesk® Inventor® software. Knowing how to access and use these tools will help you be more productive when working in an assembly.

Learning Objectives in This Chapter

- Add a constraint that permits movement of one surface relative to another.
- Add a constraint that permits movement of one surface relative to a continuous set of surfaces.
- Use various methods to assemble multiple components in an assembly.
- Clarify and organize an assembly by sorting and changing the display names and folder structure in the Model browser.
- Replace a selected component in an assembly with a copy of itself.
- Access additional constraint options, including assigning specific constraint names and limits.
- Identify assembly components that have degrees of freedom.
- Constrain components in reference to a user coordinate system (UCS), another component's origin, or the assembly's origin.

1.1 Assembly Motion Constraints

In addition to the five assembly constraints (mate, angle, tangent, insert, and symmetry), a motion constraint can also be used to describe the movement of one surface relative to another. You cannot apply a Drive to a motion constraint.

How To: Create a Motion Constraint

1. Create and place components into an assembly.
2. In the *Assemble* tab>Position panel, click (Constrain) to create a constraint relationship. Select the *Motion* tab in the Place Constraint dialog box, as shown in Figure 1–1.

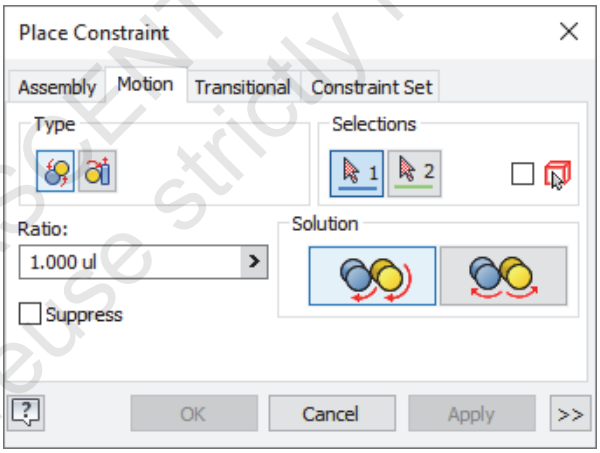


Figure 1–1

3. Select the motion type and references. References can be applied between linear, planar, cylindrical, and conical elements on two components. You can create two types of motion constraints:
   - Use (Rotation) to constrain one component relative to another, so that one component rotates when the other rotates (e.g., pulleys or gears), as shown in Figure 1–2. To assign the constraint, select the component surfaces.

(Pick part first) limits the geometry that is available for selection to a single component. It is useful when components are in close proximity or partially obscured by one another.

Two rotating components

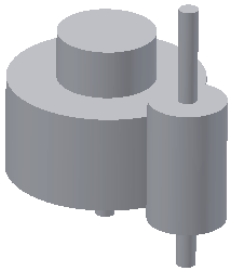


Figure 1–2

- Use (Rotation-Translation) to move (translate) one component when the other one rotates (e.g., a rack and pinion), as shown in Figure 1–3. To assign the constraint, select a surface on the rotating component and an edge on the moving component.

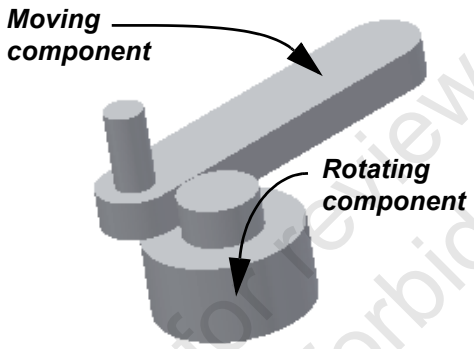


Figure 1–3

4. Select the motion type solution.
   - For a rotation motion constraint, the two solutions shown in Figure 1–4 enable you to define the direction the components rotate relative to one another (forward or reverse).

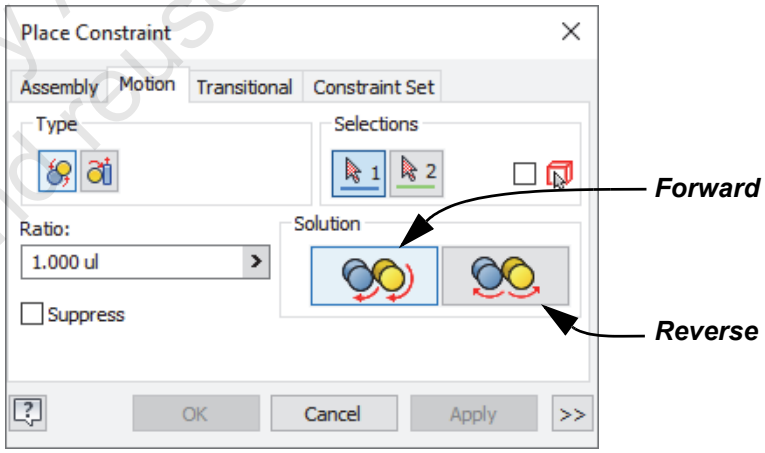


Figure 1–4

- For a rotation-translation motion constraint, the solutions shown in Figure 1–5 enable you to define the direction the components rotate and move relative to one another (forward or reverse).

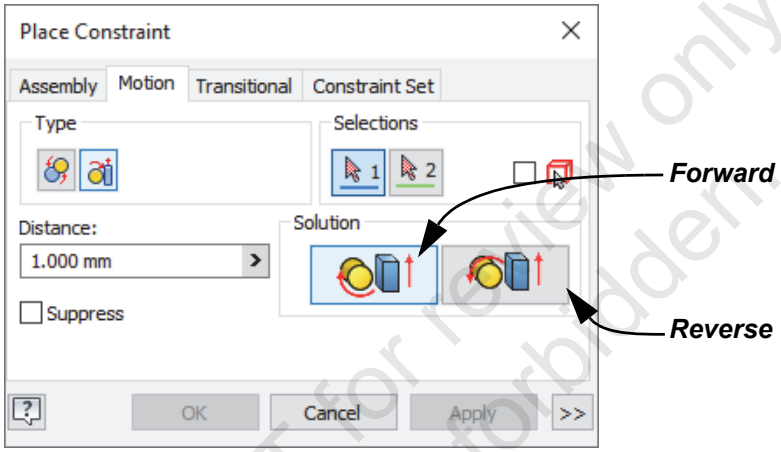


Figure 1–5

5. Enter the *Ratio* and *Distance* values.
   - For rotation constraints, enter a ratio in the *Ratio* field to determine how many revolutions the second component makes per revolution of the first. By default, the ratio relative to the circumferences is automatically calculated and therefore the order of selection is important.
   - For rotation-translation constraints, enter a distance in the *Distance* field. The distance determines how far the second component moves per revolution of the first. If the first component selected is a cylindrical surface, the software sets the distance to the circumference of the cylinder.

*Select **Suppress** in the Place Constraint to suppress the constraint after creation.*

6. Click **Apply** to complete constraint placement and continue adding constraints. Once the component is fully constrained, click **OK** to close the Place Constraint dialog box.

1.2 Assembly Transitional Constraints

In addition to the five assembly constraints (mate, angle, tangent, insert, and symmetry), a transitional constraint can also be used to describe the movement of one surface relative to a continuous set of surfaces, such as a cam in a slot of an assembly, as shown in Figure 1–6. You cannot use the drive constraint tool for transitional constraints.

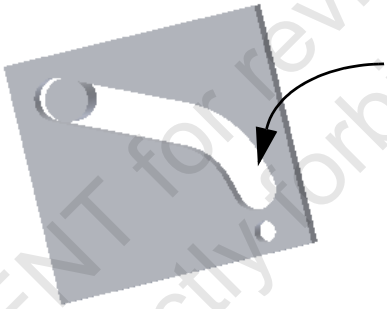


Figure 1–6

How To: Create a Transitional Constraint

1. Create and place components into an assembly.
2. In the *Assemble* tab>Position panel, click (Constrain) to create a constraint relationship. Select the *Transitional* tab in the Place Constraint dialog box, as shown in Figure 1–7.

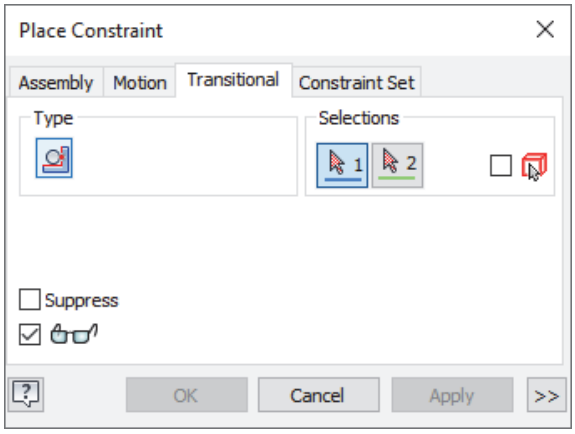


Figure 1–7

3. Select the surfaces on both components that are in contact.
   - To display a preview of the constraint, ensure that (Preview) is enabled.

Use (Pick part first) to limit the geometry that is available for selection to a single component.

*Select **Suppress** in the Place Constraint to suppress the constraint after creation.*

4. Click **Apply** to complete constraint placement and continue adding constraints. Once the component is fully constrained, click **OK** to close the Place Constraint dialog box.

1.3 Tips for Working with Assemblies

Multiple Component Placement

Consider the following when assembling multiple components in an assembly:

- Multiple components can be placed in an assembly at the same time.
  - Hold <Ctrl> to select individual components or <Shift> to select a range of components.
  - Components are assembled and sorted alphabetically.
  - When placing, if you right-click and select **Place Grounded at Origin**, all of the components placed are grounded. Alternatively, once placed, you can ground an individual component by right-clicking its name in the Model browser and selecting **Grounded**.
- To place multiple instances of a single component, place the first instance and then drag and drop additional instances from the Model browser.
  - Any constraints assigned to the initial instance relationships are lost and must be reassigned.
  - To help maintain the orientation of the last assembled instance, you can select **Use last occurrence orientation for component placement** in the *Assembly* tab, in the Application Options dialog box.
- If using the AutoDrop functionality with the Content Center, multiple components can be retrieved into the assembly, provided the selected reference has other similar references on the same placement face.
  - For example, with AutoDrop you can place eight instances of the same fastener on eight holes on the same face, if they are all the same size. The AutoDrop functionality is discussed more in depth with the Design Accelerator.

Assembly Folders

Assembly folders help organize an assembly by grouping components and simplifying the Model browser. Unlike subassemblies, folders do not create a component. Folders have no impact on relationships or degrees of freedom and do not become a rigid body.

To create a folder, use either of the following:

- Right-click on the component(s) you want to add to the folder and select **Add to New Folder**, as shown in Figure 1–8.
- Right-click on the model name at the top of the Model browser and select **Create New Folder**. Once a folder is created, you can drag-and-drop components into or out of the folder.

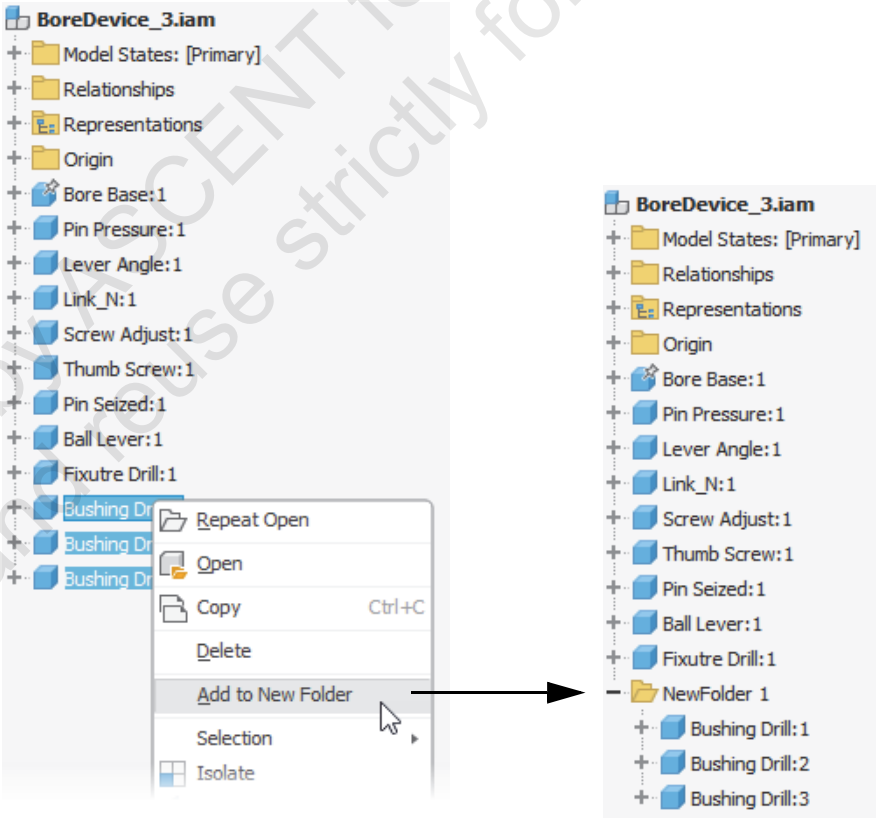


Figure 1–8

To rename the folder, select the folder in the Model browser (do not double-click), then click on the folder again and enter a new name.

Save and Replace Components

The **Save and Replace** option enables you to replace a selected component in an assembly with a copy of itself. The newly created copy maintains all the same relationships as the original component. This tool can be used to test design scenarios in assemblies.

How To: Replace a Component with a Saved Copy

1. In the *Assemble* tab>expanded Productivity panel, click  (Save and Replace).
2. Select the component to be replaced.
3. In the Create Part dialog box, enter a name for the newly copied component and click **Save**. The selected component is replaced with the copy.

Alpha Sort Component

The **Alpha Sort Component** option (*Assemble* tab>expanded Productivity panel>  (Alpha Sort Component)) enables you to sort assembly components alphabetically in the Model browser. This option does not sort items in subassemblies.

Rename Browser Nodes

The **Rename Browser Nodes** option (*Assemble* tab>expanded Productivity panel>  (Rename Browser Nodes)) changes the way browser nodes display. Components can be displayed in the browser by filename, part number, or in the default configuration. This option enables you to quickly change the long names that often display from content center items, as well as switch from filenames to your company part numbering schemes. Using this option with  (Alpha Sort Component), you can quickly sort Browser nodes as required.

1.4 Tips for Working with Assembly Relationships

Expanded Constraint Options

When assigning a constraint using the Place Constraint dialog box, you can click >> to access additional options. Consider the following:

- You can assign a custom name to the constraint to help identify it.
- Set limit values for a translational or rotational constraint, as shown in Figure 1–9. This assigns a maximum and minimum allowable range for the *Offset* or *Angle* values used when assigning a constraint. A constraint with limits has **+/-** appended to its name.
- The **Use Offset As Resting Position** option uses the specified *Offset* value as the resting position. If not set, you can drag and move the component within the range of values and the component rests where it is dropped.

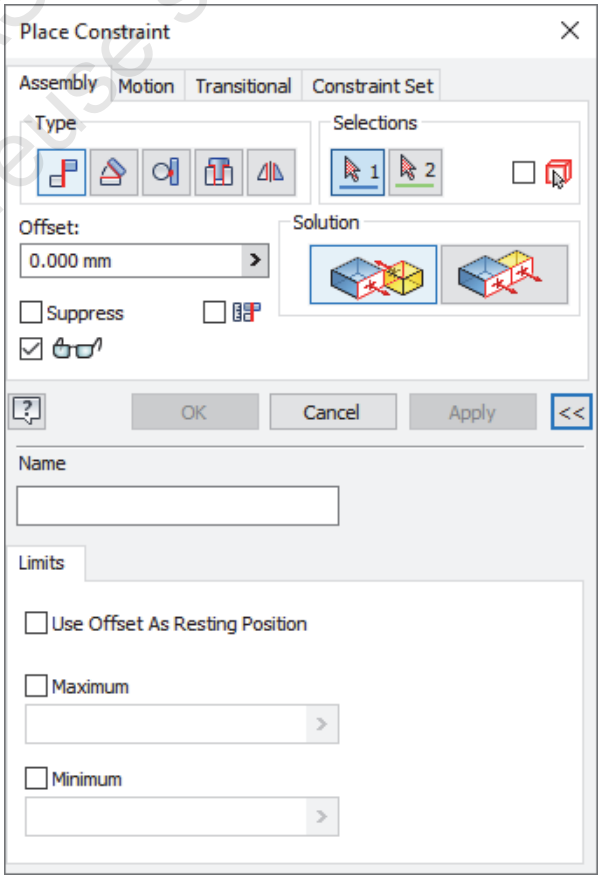


Figure 1–9

Constraint States

You can identify if components are fully constrained in the Model browser by reviewing the constraint state icons associated with each of the assembly components, as shown in Figure 1–10.

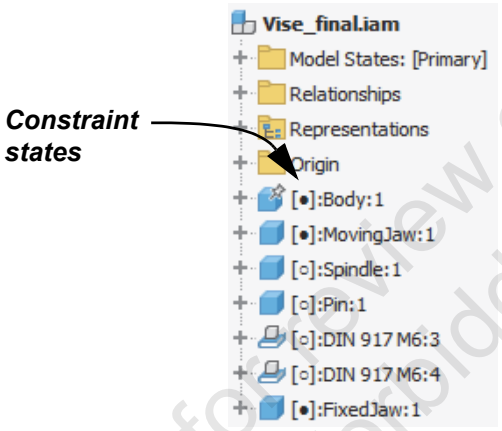


Figure 1–10

The icons describe the constraint state, as follows:

- The [•] icon adjacent to a component name indicates that the component is fully constrained.
- The [○] icon adjacent to a component name indicates that the component is not fully constrained. To review which degrees of freedom remain, you must review the existing constraints.
- The [-] icon adjacent to a component name indicates that the component constraint status is unknown. To attempt to resolve, in the *Manage* tab>Update panel, click **Rebuild All**, or review constraints and assign as needed.

The (Pushpin) icon adjacent to a component name also indicates that it is grounded (fully constrained).

Hint: Enabling the Display of Constraint States

Constraint states were introduced in Inventor 2022, and the default 2022 templates have them set to display by default. If they are not displayed, the assembly may have been created in an older version. To turn on constraint states, expand (Advanced Settings Menu) and select **Display Preferences>Show Constraint State**. Alternatively, you can set the **Show Constraint State in Browser** option from the *Tools* tab>**Document Settings**>*Modeling* tab.

Constraint Display Preferences

You can manipulate the display of the Model browser using the **Display Preferences** options shown in Figure 1–11 and described below.

- Use **Hide Fully Constrained** to quickly turn off the display of components that are fully constrained in the assembly.
- Enable the **Show Constraint State** option to display the icons ([-], [○], [●]) to help you identify the constraint status of a component. You can disable this option to turn off the display of the icons.

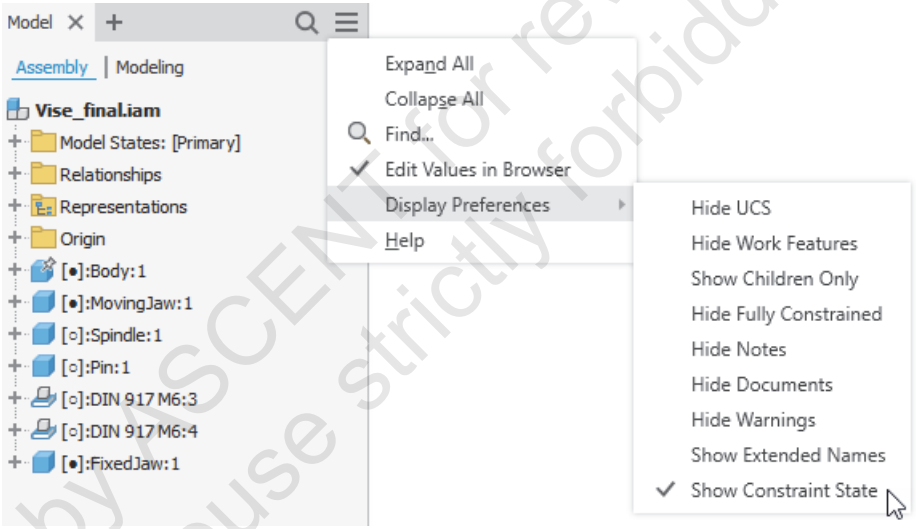


Figure 1–11

Relationship Highlighting

When you select or hover the cursor over a constraint or joint connection in the Model browser, the assembly references are highlighted on the screen. The first and second references uniquely match their color indicator under the respective arrow in the Place Constraint and the Place Joint dialog boxes.

Degree of Freedom Analysis

In the *Assemble* tab>Productivity panel, click (Degree of Freedom Analysis) to open the Degree of Freedom Analysis dialog box.This tool provides a summary of the degrees of freedom remaining in all assembly components.

- Information on the remaining translational and rotational degrees of freedom for each component is presented.
- Select a component in the dialog box to graphically view the remaining degrees of freedom, as shown in Figure 1–12.
- Select the **Animate Freedom** option to visually animate the degrees of freedom remaining on the selected component.

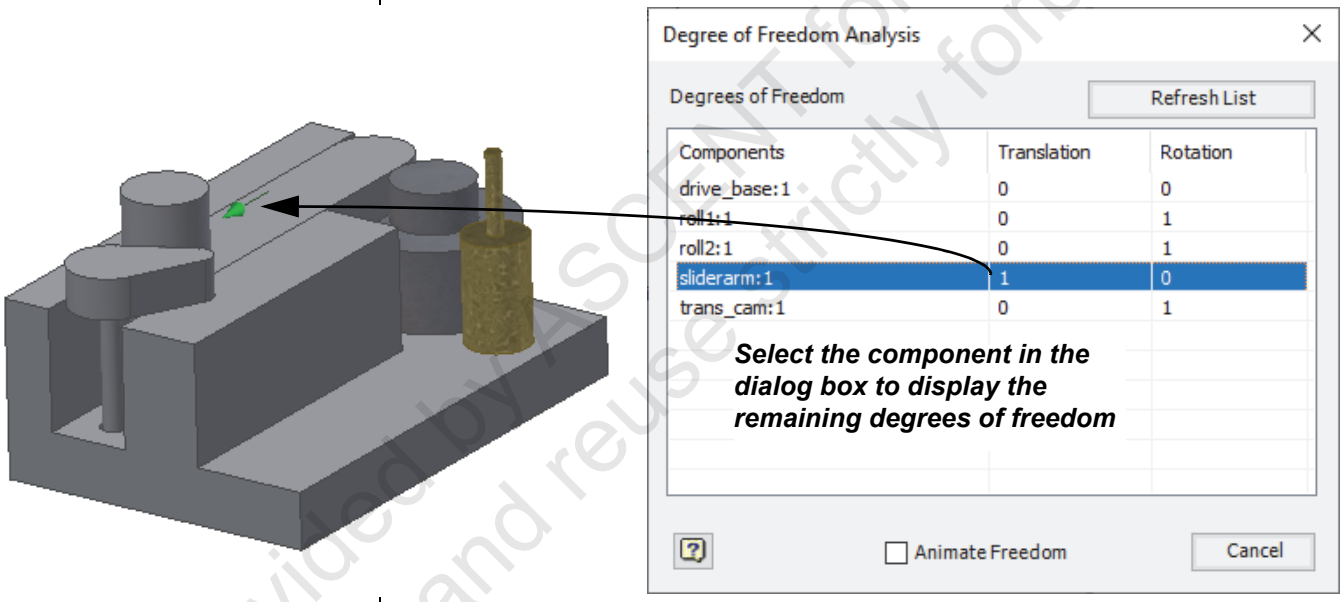


Figure 1–12

Show Relationship Name

*This command is especially useful when the Assembly browser is in Modeling View because you can see the component names listed in the **Relationships** folder.*

You can display the names of components next to the applicable constraint and joint listings in the Model browser, as shown in Figure 1–13. To display the component names, select **Display component names after relationship names** in the *Assembly* tab in the Application Options dialog box (*Tools* tab>Options panel> (Application Options)).

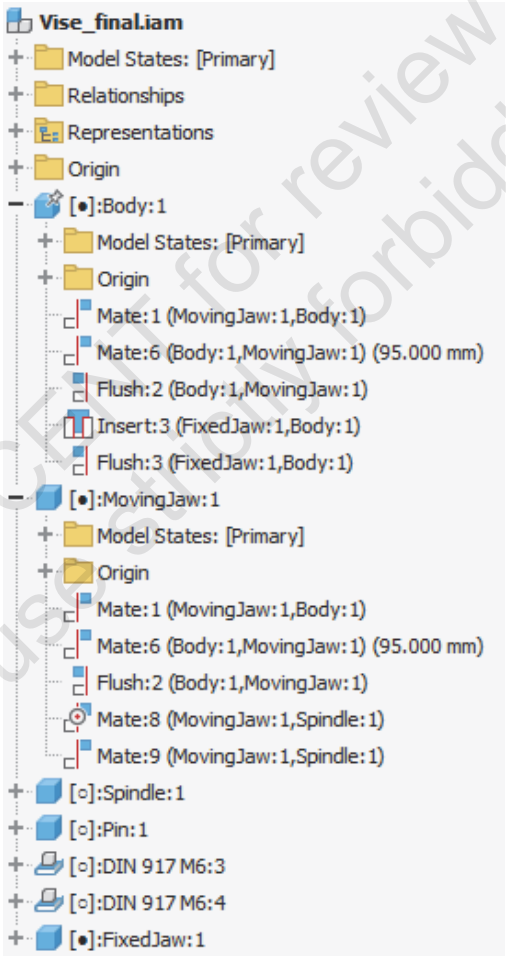


Figure 1–13

Assembling Using a UCS and Constraint Sets

A user coordinate system (UCS) consists of three planes, three axes, and a center point. The only difference between a UCS and the Origin is that you can have multiple UCSs in a model, which can all be oriented differently. Once created, a UCS is listed in the Model browser at the point it was created. It is identified by a special triad icon, as well as a sequential number associated with its feature name.

A UCS can be used as a reference in constraining components using the *Constraint Set* tab in the Place Constraint dialog box, as shown in Figure 1–14. UCS Constraint Sets match Plane to Plane, Axis to Axis, and Origin to Origin to locate two components relative to one another. To constrain the components, select the UCS in each component.

This tab only enables you to constrain one UCS to another UCS. UCS references cannot be used as references for Joint connections.

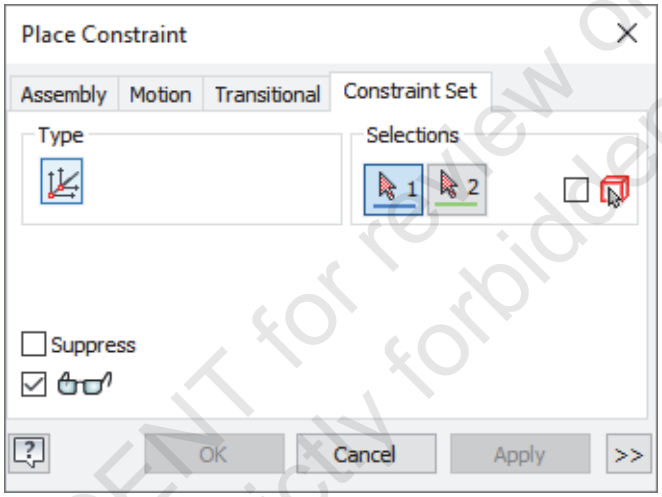


Figure 1–14

Place at Component Origin

The **Place at Component Origin** option enables you to quickly constrain a newly added component to an existing assembly component. The system automatically creates three mate flush constraints to align the YZ, XZ, and XY planes from each component.

How To: Place a Newly Added Component at an Existing Component's Origin

1. In the *Assemble* tab>Productivity panel, click (Place at Component Origin).
2. In the graphic window or Model browser, select the existing component to which the newly placed component is going be constrained.
3. In the Open dialog box, select a component or multiple components to be added to the assembly and click **Open**.

Ground and Root Component

If existing relationships are in conflict, the ⚠ *icon displays and must be manually resolved.*

The **Ground and Root** option (*Assemble* tab> expanded Productivity panel> ) enables you to do all of the following in a single operation:

- Ground a selected component (**Ground at Origin**).
- Align the origin of a selected component with the origin of the assembly (**Create origin flush constraints**). Three flush constraints are added to mate flush the YZ, XZ, and XY planes in the selected component and the assembly.
- Reposition a selected component as the first component in the Model browser (**Reposition to the top of the browser**).

Assembly Restructure

You can promote and demote components in an assembly structure without losing their relationships. To promote or demote, right-click on a component and select **Component> Promote** or **Component>Demote**.

When demoting you are prompted to create a new subassembly. If a subassembly already exists, select and drag the component into the subassembly to demote it. Dragging and dropping can also be used to promote a component.

Practice 1a

Motion and Transitional Constraints

Practice Objectives

- Relate the motion of one component to another component by adding motion and transitional constraint relationships.
- Simulate motion in an assembly by driving a newly added angle constraint relationship.

In this practice, you will use motion and transitional constraints to relate the motion of one part to another part in an assembly. You will apply an Angle constraint to two assembly components and simulate motion in the assembly by driving the angle constraint. The assembly is shown in Figure 1–15.

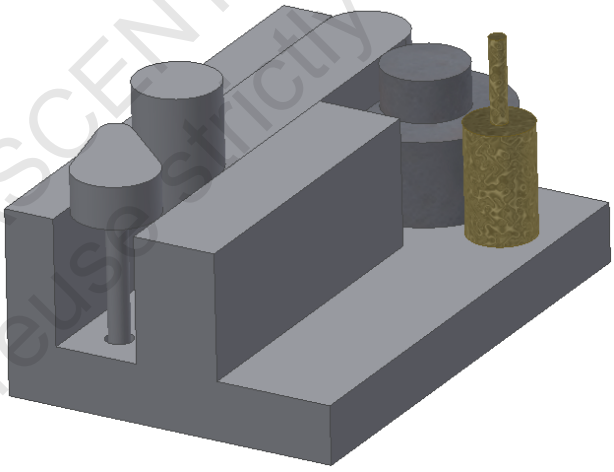


Figure 1–15

Task 1 - Open an assembly file.

This project file is used for the entire learning guide.

1. On the Home page, select (Projects and Settings) > **Settings** to open the Projects dialog box. Project files identify folders that contain the required models.
2. Click **Browse**. In the practice files folder, select **Advanced Assembly.ipj**. Click **Open**. The Projects dialog box updates and a checkmark displays next to the new project name, indicating that it is the active project. The project file tells Autodesk Inventor where your files are stored. Click **Done**.
3. Open **drive.iam** from the top-level practice files folder. Textures have been added to the two **Roll** components so that you can easily identify them when they are rotating.

4. Examine the existing relationships in the assembly and display the components' degrees of freedom. To display the degrees of freedom, switch to the *View* tab>Visibility panel and click (Degrees of Freedom). The **drive_base** component is grounded. The **roll1** and **roll2** components are free to rotate about their central axes, and the **sliderarm** is free to slide in one direction only.

5. As an alternative to simply displaying the degrees of freedom for the components, you can run an analysis. In the *Assemble* tab>expanded Productivity panel, click (Degree of Freedom Analysis). The Degree of Freedom Analysis dialog box opens, as shown in Figure 1–16. The **sliderarm** can translate, and the **roll1** and **roll2** components can rotate.

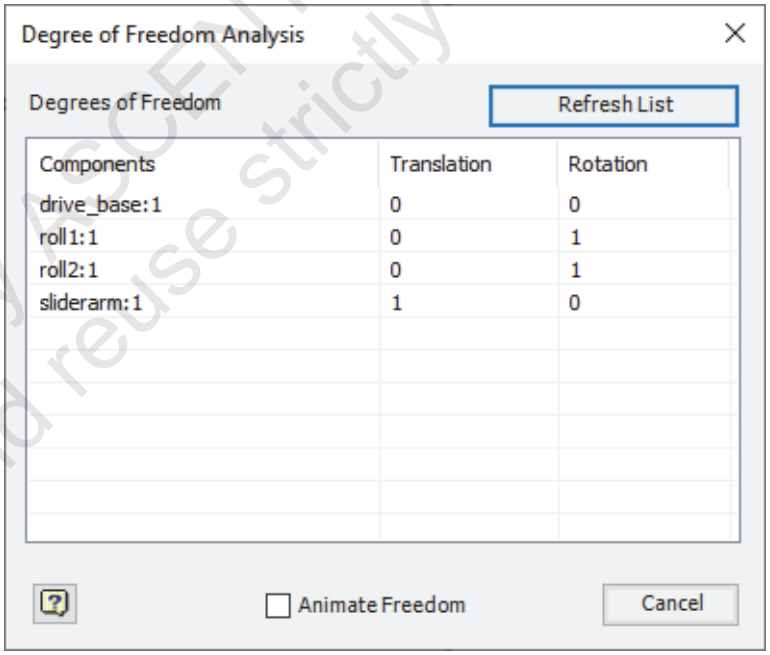


Figure 1–16

6. Select **Animate Freedom** at the bottom of the dialog box.

7. Select the **sliderarm** component in the dialog box and note the translational movement of the component.

8. Select the **roll1** and **roll2** components in the dialog box to see their rotational freedom. Using the **Degree of Freedom Analysis** command enables you to visualize more easily the available degrees of freedom in an assembly.

9. Click **Cancel** to close the dialog box.

The (Axial Mate) symbol displays when a mate constraint is used to align the axes of cylindrical or conical features.

Task 2 - Place and constrain trans_cam.ipt.

1. Place one instance of **trans_cam.ipt** in the assembly.
2. Apply a Mate constraint between the center line of the **trans_cam** rod and the center line of the round hole in **drive_base.ipt**, as shown in Figure 1–17.

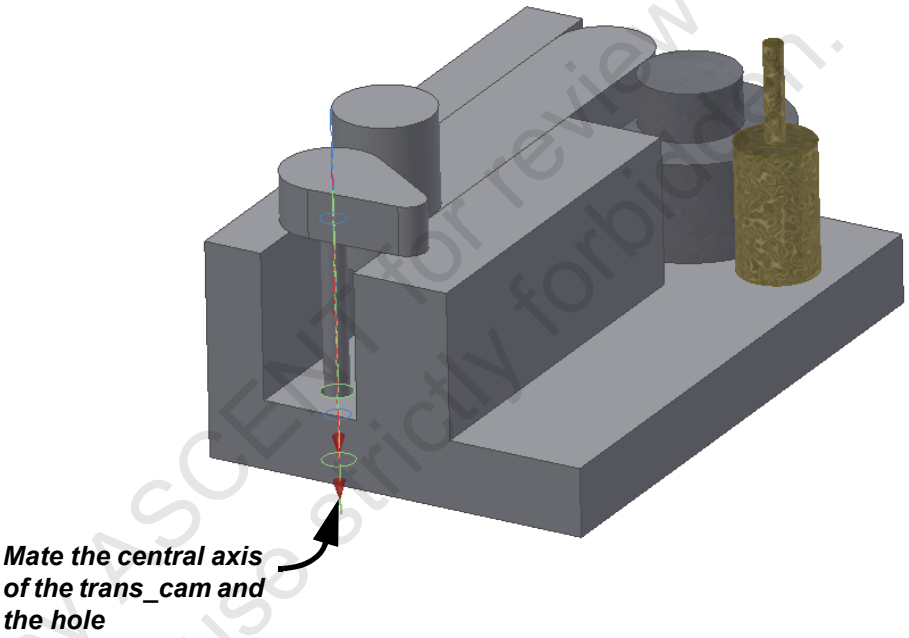


Figure 1–17

3. Apply a Mate constraint between the surfaces shown in Figure 1–18. One rotational degree of freedom remains.

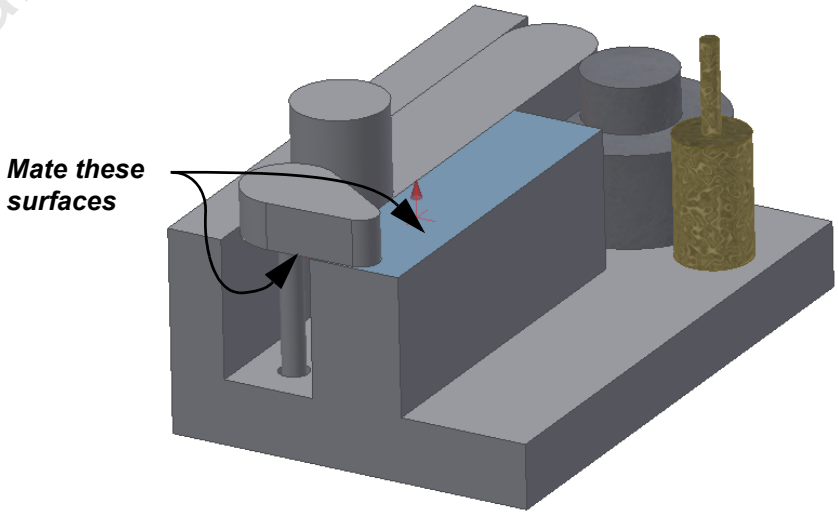


Figure 1–18

4. Open the Place Constraint dialog box, if not already open, and select the *Motion* tab.

5. Apply a  (Rotation) motion constraint between the outside cylindrical faces of **Roll1** and **Roll2**. Select **Roll1** first (the smaller cylinder) and **Roll 2** second (the larger cylinder). Based on the order that you selected, the default ratio is .40. The ratio determines how many revolutions the second component makes per revolution of the first.

6. Set the parts to rotate in the reverse direction, as shown in Figure 1–19, by clicking  . Click **OK**.

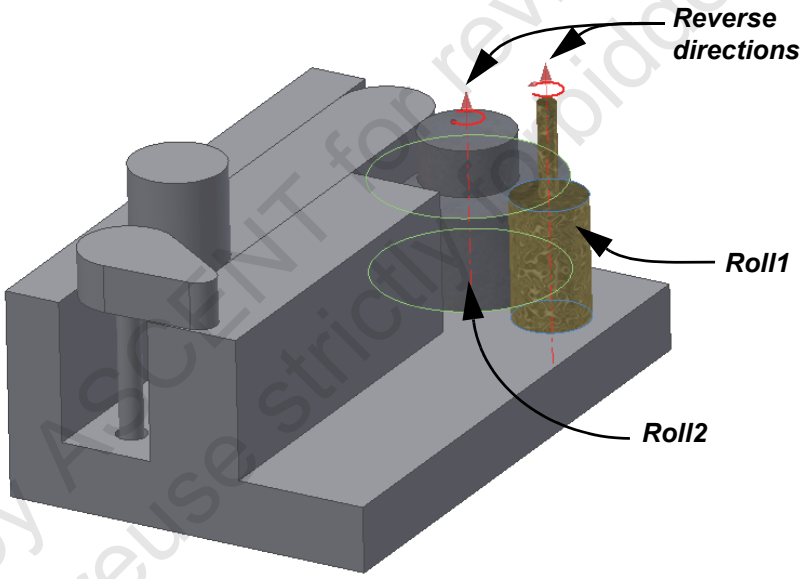


Figure 1–19

7. Select the **Roll1** component and drag it to simulate motion.

8. Apply a  (Rotation-Translation) motion constraint between **Roll2** and **Sliderarm**. Select **Roll2** first and the **Sliderarm** edge second, as shown in Figure 1–20. Set the motion to rotate in the Forward direction by clicking  . Click **OK**.

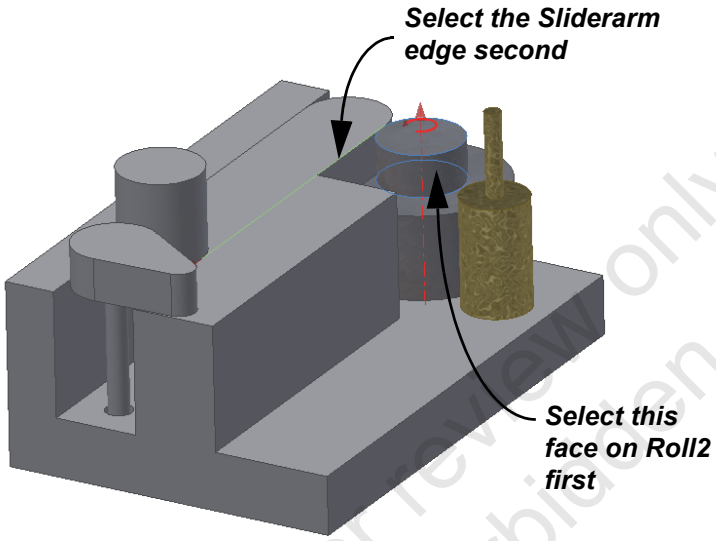


Figure 1–20

9. Select the **Roll2** component and drag it to simulate motion. When **Roll2** rotates, **Sliderarm** translates and **Roll1** rotates. You can also select and drag **Sliderarm** or **Roll1**.

10. In the Place Constraint dialog box, select the *Transitional* tab.

11. Place a  (Transitional) constraint between the cylindrical portion of the Slider arm and the round face of **trans_cam**, as shown in Figure 1–21. Select the cylinder first and a surface on **trans_cam** second. Click **OK**.

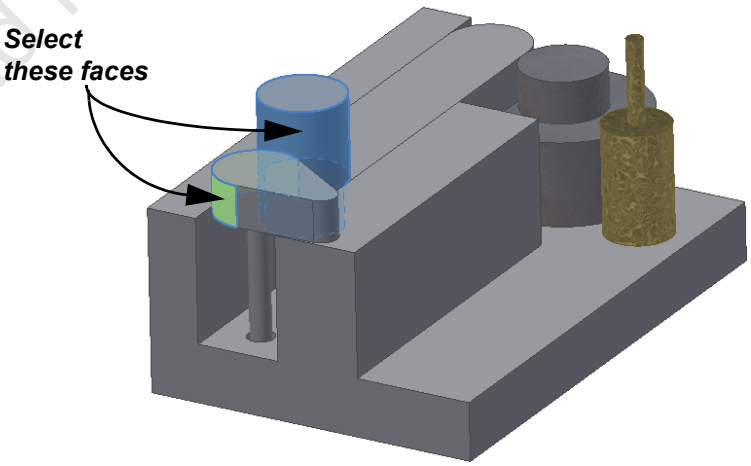


Figure 1–21

12. Select and drag **trans_cam** back and forth to rotate it. The other constrained parts should move according to their relationships.

Task 3 - Drive a constraint.

In this task, you apply an Angle constraint between **sliderarm** and **trans_cam**, and then use this relationship to simulate motion.

When you apply the Angle constraint, you might lose the transitional constraint references. Edit it and re-apply the references in the Edit Constraint dialog box.

1. Apply an Angle constraint between the XZ Plane of **sliderarm** and the YZ Plane of **trans_cam**.
2. Click  (Directed Angle).
3. Type **0.00** as the angle between the two planes, and click **OK** to apply the constraint relationship.
4. In the Model browser, right-click on the Angle constraint relationship and select **Drive**. The Drive dialog box opens.
5. Type **-60.00** in the *Start* field and **60.00** in the *End* field.
6. Expand the Drive dialog box, select **Start/End/Start**, and type **10** in the *Repetitions* field.
7. Click  to start the simulation.
8. Close the dialog box once the simulation has finished.
9. Save the file and close the window.

Practice 1b

Assembly Tools

Practice Objectives

- Investigate the remaining degrees of freedom of components in a constrained assembly.
- Vary the display and organization of the Model browser by adding an Assembly folder, and renaming and sorting nodes in the Model browser.

In this practice, you will use some assembly tools to perform a variety of tasks on the mechanical pencil assembly shown in Figure 1–22.

Figure 1–22

Task 1 - Open an assembly and view the model.

1. Open **Mechanical Pencil.iam** from the *Mechanical_Pencil_Assembly Tools* folder.
2. Select the *View* tab.
3. In the Visibility panel, click (Half Section View), as shown in Figure 1–23.

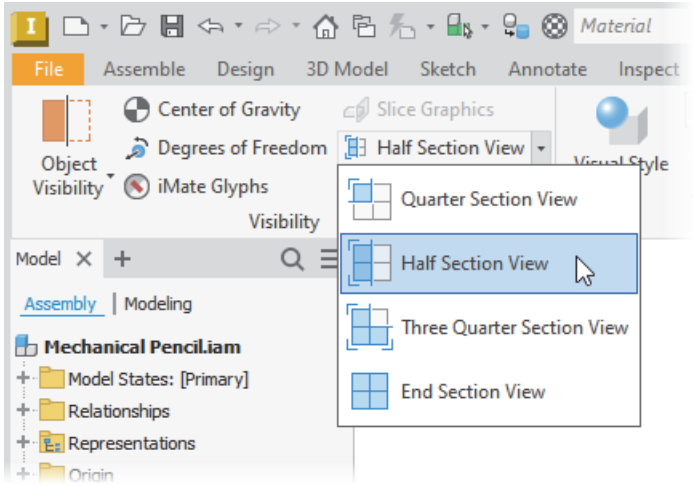


Figure 1–23

4. In the Model browser, expand the **Origin** node, select the **YZ Plane**, and click . The model displays as shown in Figure 1–24. Review the model, noting the internal detail.

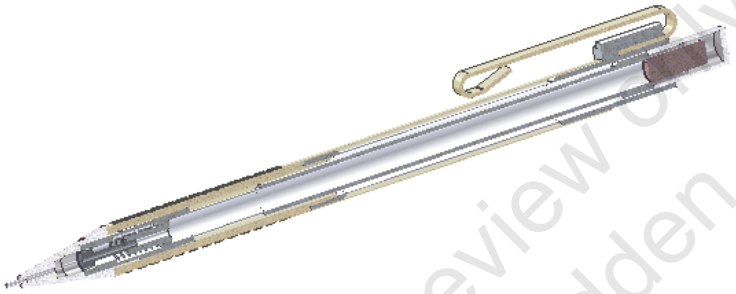


Figure 1–24

Task 2 - Investigate the degrees of freedom of the components.

In this task, you will investigate the degrees of freedom remaining in the assembly, using the Degree of Freedom Analysis dialog box. This productivity tool provides an overview of all remaining degrees of freedom for the entire assembly.

1. In the *Assemble* tab>expanded Productivity panel, click (Degree of Freedom Analysis). The Degree of Freedom Analysis dialog box opens, as shown in Figure 1–25.

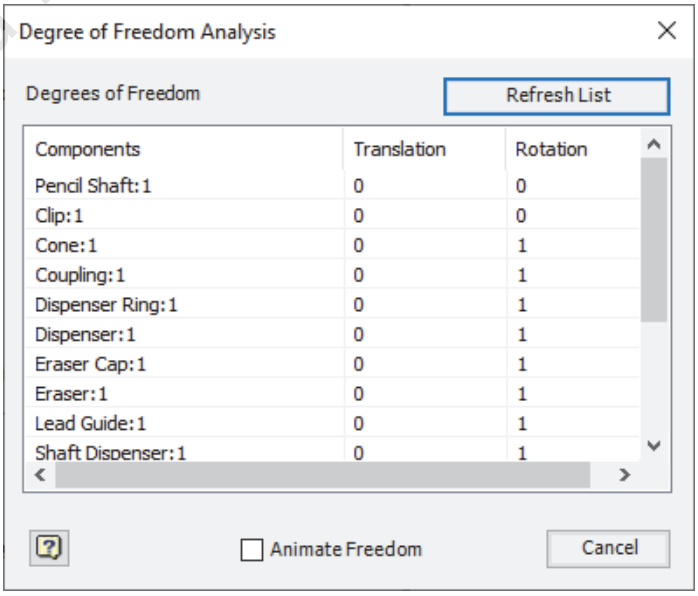


Figure 1–25

The Degree of Freedom Analysis dialog box lists all of the components in the assembly and their degrees of freedom. The components are fully constrained translationally, while some still have a rotational degree of freedom remaining.

2. In the Degree of Freedom Analysis dialog box, select the **Cone:1** component. The rotational degree of freedom highlights on the model.
3. Select **Animate Freedom**.
4. Zoom in on the tip section of the pencil, as shown in Figure 1–26, and select the **Spring:1** component in the dialog box. The degree of freedom remaining for the spring is animated on the screen.

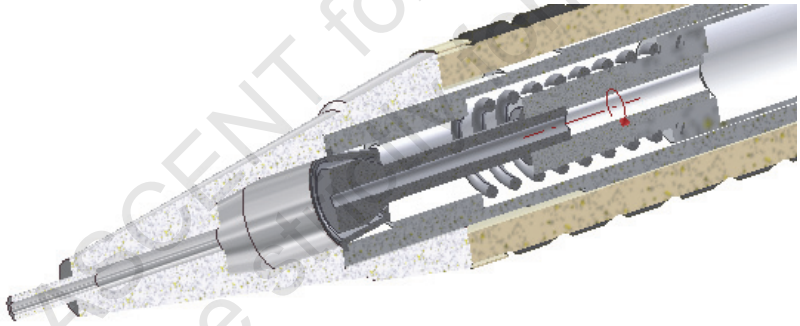


Figure 1–26

5. Select other components to observe their remaining degrees of freedom. Maintaining a rotational degree of freedom in the components is acceptable for this assembly.
6. Click **Cancel** to close the dialog box.

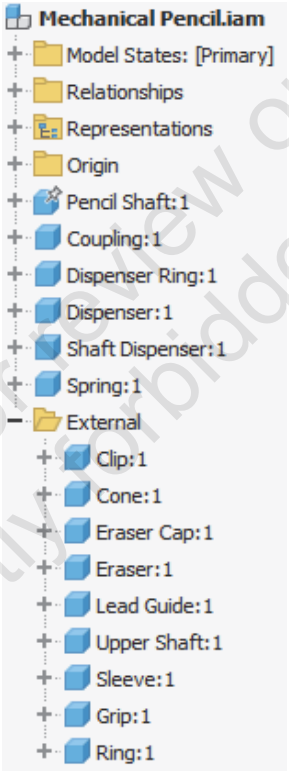
Task 3 - Create an assembly folder.

In this task, you will create an assembly folder. Assembly folders help organize the Model browser and quickly manipulate features inside the folder.

1. In the Model browser, right-click on **Mechanical Pencil.iam** and select **Create New Folder**.
2. Type **External** as the folder name and press <Enter>.

You can drag all of the components into the Assembly folder in a single operation by pressing <Ctrl> while selecting the components.

3. Drag the **Clip**, **Cone**, **Eraser Cap**, **Eraser**, **Lead Guide**, **Upper Shaft**, **Sleeve**, **Grip**, and **Ring** components into the *External* assembly folder, as shown in Figure 1–27.



The order of the components might be different for you

Figure 1–27

4. In the Model browser, right-click on the *External* folder and clear the **Visibility** option. The model displays as shown in Figure 1–28. All components were cleared at once.

Figure 1–28

5. Toggle the **Visibility** of the *External* folder back on.

Task 4 - Reorganize the Model browser.

In this task, you will use two productivity tools to reorganize the Model browser: **Rename Browser Nodes** and **Alpha Sort Components**.

1. In the expanded Productivity panel, click (Rename Browser Nodes).
2. In the New Name drop-down list, select **Filename**, as shown in Figure 1–29, and click **Apply**. The Model browser updates to display the full filename of each component.

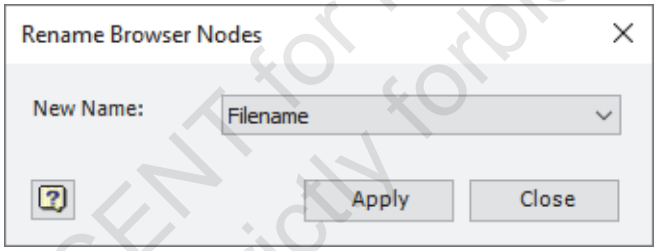


Figure 1–29

3. In the New Name drop-down list, select **Part Number** and click **Apply**. The Model browser updates to display the part number for each component.
4. Click **Close**.
5. In the expanded Productivity panel, click (Alpha Sort Component). The Model browser is reordered by part number.
6. Expand the *External* assembly folder. The components inside the folder were also sorted. A limitation of this command is that it will not sort subassemblies. For subassemblies, you must activate a subassembly first and then sort it.
7. Right-click on the *External* assembly folder and select **Delete Folder**. The folder is removed from the Model browser and the components in it are placed back into the top level of the browser.
8. Run the **Alpha Sort Component** command again.

9. The grounded part is now buried in the Model browser. To correct this, drag **PP-09** back to the top of the browser, as shown in Figure 1–30.

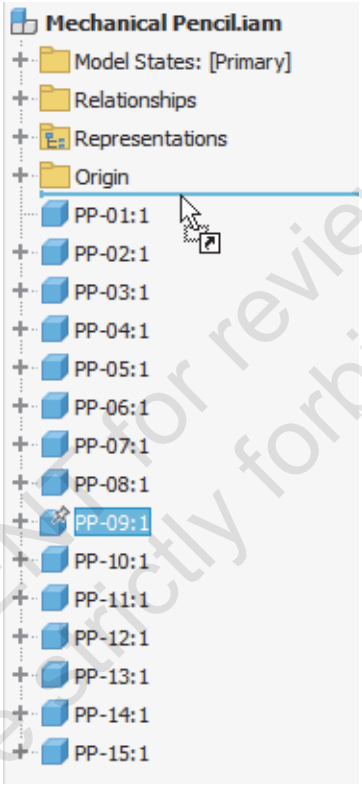


Figure 1–30

10. Save the file and close the window.

Chapter Review Questions

1. What is the purpose of using an assembly folder?
   a. To store component files.
   b. To promote components.
   c. To help organize an assembly.
   d. To demote components.
2. Assembly folders have an impact on the relationships/ degrees of freedom of the components in the folder.
   a. True
   b. False
3. What is the purpose of the *Constraint Set* tab shown in Figure 1–31?

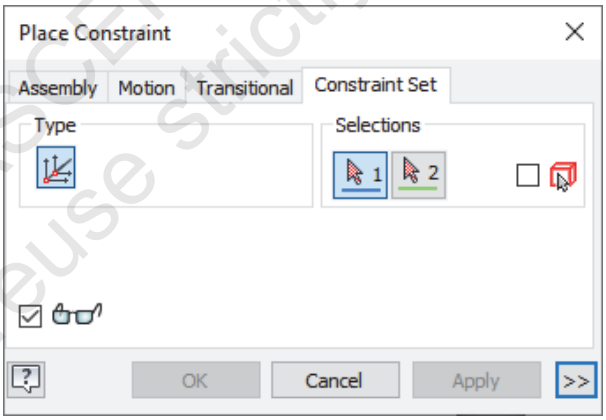


Figure 1–31

   a. Adds multiple constraints at the same time.
   b. Enables you to constrain components using a user coordinate system (UCS).
   c. Enables constraints to be grouped together.
   d. None of the above.

4. (Alpha Sort Component) sorts all of the components that exist at the top-level assembly and in subassemblies and assembly folders.
   a. True
   b. False

5. What do Motion constraints enable you to do?
   a. Describe the movement of one surface relative to another.
   b. Describe the constraints that keep components from moving.
   c. Restrict the motion of components.
6. If a Rotation motion constraint enables one component to rotate when another rotates, what does the Rotation-Translation motion constraint do?
   a. Enables two components to rotate when another rotates.
   b. They are the same.
   c. Enables one component to move translationally when another rotates.
   d. Enables one component to move translationally when another moves translationally.
7. What do Transitional constraints enable you to do?
   a. Describe the movement of one surface relative to a continuous set of surfaces.
   b. Describe the movement of one surface relative to another.
   c. Change constraint options depending on a component's other constraints.
   d. Transition from one type of constraint to another.

Command Summary

Button	Command	Location
NA	**Add to New Folder**	• (*context menu in the Model browser*)
	**Alpha Sort Component**	• **Ribbon:** *Assemble* tab>Productivity panel
	**Application Options**	• **Ribbon:** *Tools* tab>Options panel
	**Constrain**	• **Ribbon:** *Assemble* tab>Position panel
NA	**Create New Folder**	• (*context menu in the Model browser*)
	**Degree of Freedom Analysis**	• **Ribbon:** *Assemble* tab>Productivity panel
	**Ground and Root**	• **Ribbon:** *Assemble* tab>Productivity panel
	**Place**	• **Ribbon**: *Assemble* tab>Component panel
	**Place at Component Origin**	• **Ribbon**: *Assemble* tab>Productivity panel
	**Rename Browser Nodes**	• **Ribbon**: *Assemble* tab>Productivity panel
	**Save and Replace**	• **Ribbon**: *Assemble* tab>Productivity panel