Simscape™ Multibody™ Link

User's Guide

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Contents

Getting Started

1

Introduction to Simscape Multibody Link Software

2

CAD Export

Simscape Multibody Examples

3

Custom Linking to Third-Party Applications

4

Getting Started

1

Introduction to Simscape Multibody Link Software

Simscape Multibody Link Product Description

Export CAD assemblies for use in Simscape Multibody software

Simscape Multibody Link is a CAD plug-in for exporting CAD assemblies from SolidWorks®, Autodesk Inventor®, and PTC® Creo™ software. The plug-in generates an XML file detailing the structure and properties of your CAD assembly and 3-D geometry files for visualizing the various CAD parts. You can then import the files into Simscape Multibody software, which parses the XML data and automatically generates an equivalent multibody model.

Related Products

In this section...
"Required Products" on page 1-3
"Related Products" on page 1-3

Required Products

You must have access to MATLAB®, either as a local install or through a network server, in order to install the Simscape Multibody Link CAD plug-in. Simulink®, Simscape, and Simscape Multibody software are not required.

Supported Operating Systems

You can use the Simscape Multibody Link plug-in on any operating system that supports MATLAB.

Supported CAD Platforms

Simscape Multibody Link works with Autodesk Inventor, PTC Creo, and SolidWorks software. To export multibody assemblies from other platforms, you can create a custom app based on the Simscape Multibody XML schema.

Related Products

Simscape Multibody

The Simscape Multibody Link plug-in merely exports CAD assemblies—as XML files, accompanied by part geometry files. For these files to be useful, you must convert them into a Simscape Multibody model (using the `smimport` function provided in that product). You can then build on the model using the blocks of the Simscape Multibody library.

Other Simscape Products

You can expand the imported CAD model beyond the mechanical (or, more precisely, multibody) domain. Add blocks from Simscape and other physical modeling products, for example, to capture the forces of electrical motors and hydraulic actuators—including the detail of the often complex systems that power them. Physical modeling products that you can use include Simscape Driveline™ (for power trains, such as those of motor vehicles

and certain types of industrial machinery), Simscape Fluids™ (for liquid and gas systems, with or without the effects of heat exchange), and Simscape Electrical™ (for electronic and electrical power systems).

Install the Simscape Multibody Link Plug-In

In this section...
"What is Simscape Multibody Link?" on page 1-5
"Alternatives to Simscape Multibody Link" on page 1-5
"Before You Begin" on page 1-6
"Step 1: Get the Installation Files" on page 1-6
"Step 2: Run the Installation Function" on page 1-6
"Step 3: Register MATLAB as an Automation Server" on page 1-7
"Step 4: Enable the Simscape Multibody Link Plug-In" on page 1-7

What is Simscape Multibody Link?

Simscape Multibody Link is a plug-in that you install on your CAD application to export your CAD assembly models. The plug-in generates the files that you need to import the model into the Simscape Multibody environment (using the `smimport` function). You can install the plug-in on three CAD applications:

- SolidWorks
- Autodesk Inventor
- PTC Creo

Alternatives to Simscape Multibody Link

You can export an assembly model from Onshape® CAD software using the `smexportonshape` function. This function generates the same files as the Simscape Multibody Link plug-in—one an XML multibody description file, the rest a set of body geometry files.

If you use a different CAD application, you can create a custom application based on the published Simscape Multibody XML schema. This approach requires some knowledge of XML. See the schema web page for an example.

If you can export a multibody model in URDF format, then you can also import that model using the `smimport` function. This approach may suit you if your CAD application is not among those supported and you have little experience with XML schemas.

Before You Begin

You must have a valid MATLAB license and one of the supported CAD applications:

- Autodesk Inventor software
- PTC Creo software
- SolidWorks software

Your MATLAB and CAD installations must have the same system architecture—e.g., Windows 64-bit.

Step 1: Get the Installation Files

1 Go to the Simscape Multibody Link download page.

2 Follow the prompts on the download page.

3 Save the zip archive and MATLAB file in a convenient folder.

Select the file versions matching your MATLAB release number and system architecture—e.g., release R2015b and Win64 architecture. Do not extract the zip archive.

Step 2: Run the Installation Function

1 Run MATLAB as administrator.

2 Add the saved installation files to the MATLAB path.

You can do this by entering `addpath('foldername')` at the MATLAB command prompt. Replace `foldername` with the name of the folder in which you saved the installation files—e.g., `C:\Temp`.

3 At the MATLAB command prompt, enter `install_addon('zipname')`.

Replace `zipname` with the name of the zip archive—e.g., `smlink.r2015b.win64.zip`.

Step 3: Register MATLAB as an Automation Server

Each time you export a CAD assembly model, the Simscape Multibody Link plug-in attempts to connect to MATLAB. For the connection to occur, you must register MATLAB as an automation server. You can do this in two ways:

- In a MATLAB session running in administrator mode — At the command prompt, enter `regmatlabserver`.
- In an MS-DOS window running in administrator mode — At the command prompt, enter `matlab -regserver`.

Step 4: Enable the Simscape Multibody Link Plug-In

Before you can export an assembly, you must enable the Simscape Multibody Link plug-in on your CAD application. To do this, see:

- "Enable Simscape Multibody Link Inventor Plug-In"
- "Enable Simscape Multibody Link Creo-Pro/E Plug-In"
- "Enable Simscape Multibody Link SolidWorks Plug-In"

2

CAD Export

CAD Translation

Translating a CAD Model

You can translate a CAD model into an equivalent Simscape Multibody block diagram. The conversion relies on the `smimport` function featuring an XML multibody description file name as its central argument. The XML file passes to Simscape Multibody software the data it needs to recreate the original model—or an approximation of it if unsupported constraints exist in the model.

You translate a CAD model in two steps—export and import. The export step converts the CAD assembly model into an XML multibody description file and a set of STEP or STL part geometry files. The import step converts the multibody description and part geometry files into an SLX Simscape Multibody model and an M data file. The model obtains all block parameter inputs from the data file.
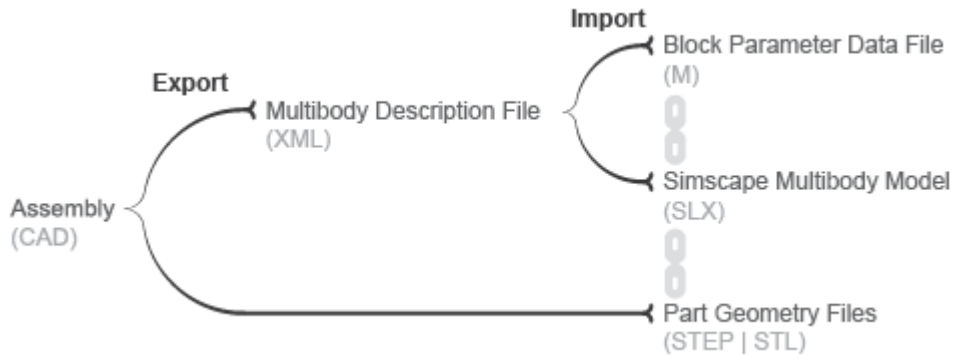
CAD Translation Steps

What's in a Translated Model?

The translated model represents the CAD parts—referred to as bodies in Simscape Multibody software—using Simulink subsystems that comprise multiple Solid and Rigid Transform blocks. The Solid blocks provide the body geometries, inertias, and colors. The Rigid Transform blocks provide the frames with the required poses for connection between bodies.
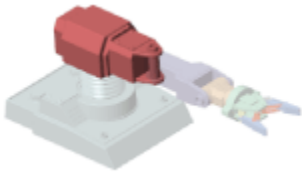
Consider the upper arm body of a CAD robotic arm model, shown in the figure. The Simulink subsystem for this body consists of one Solid block connected to a pair of Rigid Transform blocks. The Solid block provides the reference to the upper arm geometry file and the inertial properties derived from the CAD model. The Rigid Transform blocks provide the frames for connection to the robot base and lower arm bodies.
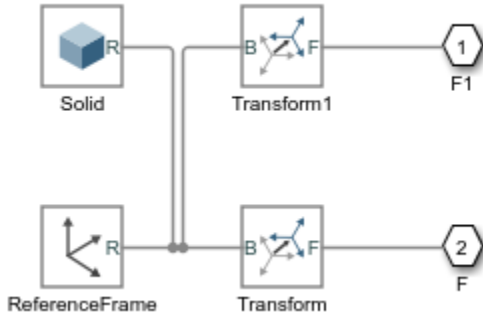
Simulink Subsystem Representing Upper Arm Body

CAD joints, constraints, and mates translate into Simscape Multibody software as combinations of joint and constraint blocks. In the CAD robotic arm example, the constraints between the upper arm and the lower arm translate into a Revolute Joint block. This block sits between the Simulink Subsystem blocks that represent the upper arm and lower arm bodies.
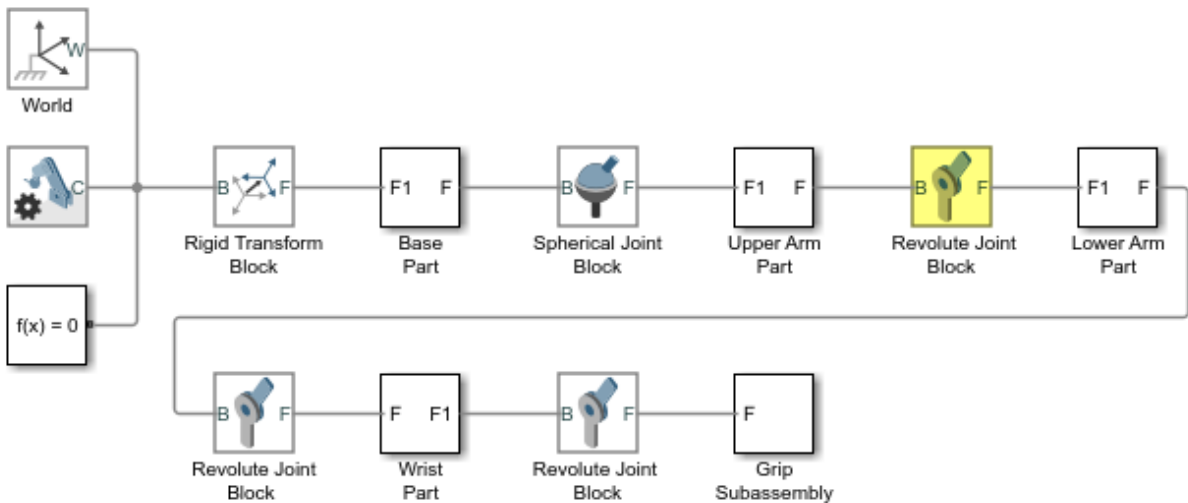
Simulink Subsystem Representing Upper Arm Body

By default, the translated model preserves the structural hierarchy of the original CAD model. If the source model is a CAD model with multibody subassemblies, the subassemblies convert in Simscape Multibody software into multibody Simulink subsystems. Consider again the CAD robotic arm model. The model contains a grip multibody subassembly with seven bodies, shown schematically in the figure.
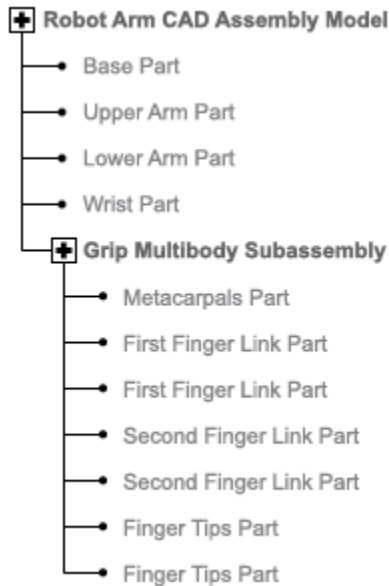
CAD Robotic Arm Model Hierarchy

During translation, the grip subassembly converts into a Simulink subsystem with seven Simulink subsystems, one for each body.
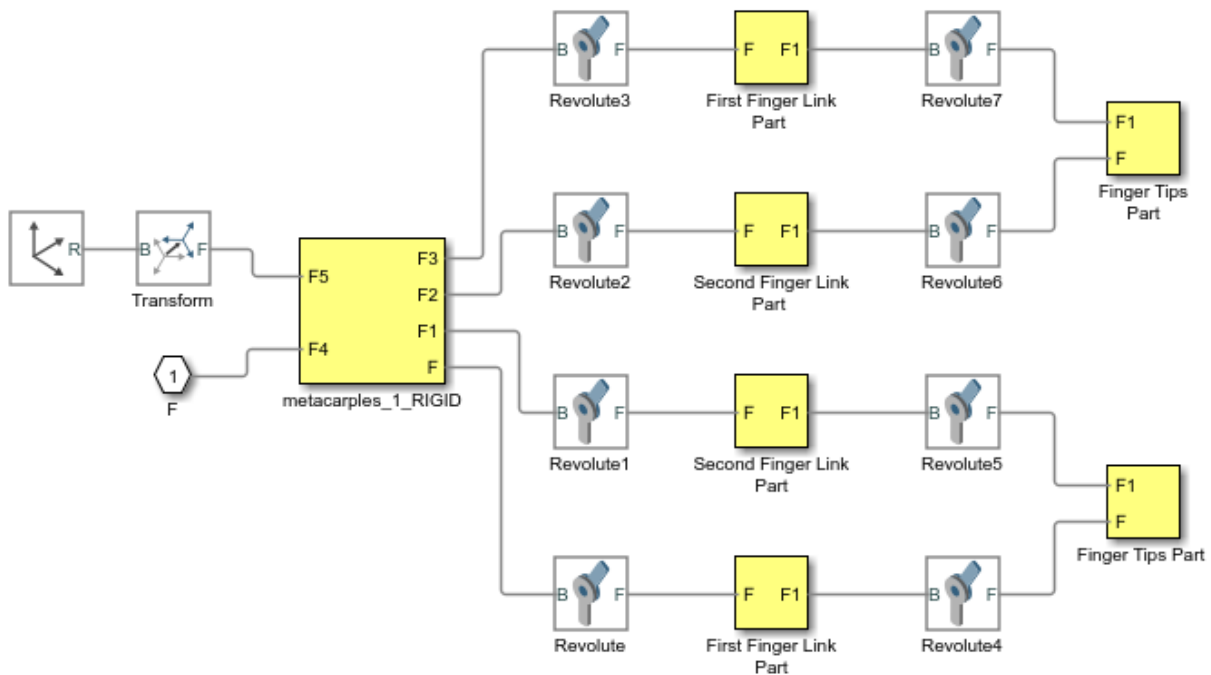
Multibody Simulink Subsystem with Body Simulink Subsystems

What's in a Data File?

Blocks in the translated model are parameterized in terms of MATLAB variables defined in the data file. These variables are stored in structure arrays named after the various block types. The structure arrays are nested in a parent data structure named `smiData` or a custom string that you specify.

Consider an imported model with a data structure named `smiData`. If the model contains Revolute Joint blocks, the parameter data for these blocks is the structure array `smiData.RevoluteJoint`. This structure array contains a number of data fields, each corresponding to a different block parameter.

The structure array fields are named after the block parameters. For example, the position state target data for the Revolute Joint blocks is in a field named `Rz_Position_Target`. If the model has two Revolute Joint blocks, this field contains two

entries—`smiData.RevoluteJoint(1).Rz_Position_Target` and `smiData.RevoluteJoint(2).Rz_Position_target`.

Each structure array index corresponds to a specific block in the imported model. The index assignments can change if you regenerate a data file from an updated XML multibody description file. The `smimport` function checks the prior data file, when specified, to ensure the index assignments remain the same. See "Updating an Existing Data File" (Simscape Multibody).

Exporting a CAD Model

You can technically export a CAD assembly model from any CAD application. The Simscape Multibody Link CAD plug-in provides one means to export a model in a valid XML format. The plug-in is compatible with three desktop CAD applications: SolidWorks, PTC Creo, and Autodesk® Inventor®. The plug-in generates not only the XML multibody description file but also any geometry files required for visualization in the final translated model.

The Simscape Multibody `smexportonshape` function provides another means to export a CAD model, from a cloud application named Onshape. This function exports in a format compatible with the newer Simscape Multibody blocks only. See "Onshape Import" (Simscape Multibody) for more information on exporting (and importing) CAD models from an Onshape account.

If you use an unsupported CAD application, you can create a program that uses the CAD API and Simscape Multibody XML schema to generate the multibody description and part geometry files. This task requires knowledge of XML documents, XSD schema definitions, and CAD APIs. See the schema website for the XSD schema definitions. See MATLAB Central for an example program built on the SolidWorks CAD API.

If a URDF converter exists for your CAD application, you may be able to export your model in URDF format and import the URDF file into the Simscape Multibody environment. Note, however, that the URDF specification forbids closed-chain model topologies, such as those of four-bar linkages and gear assemblies. For more information, see "URDF Import" (Simscape Multibody).

A Note About Export Errors

If the Simscape Multibody Link plug-in cannot export a part geometry file or translate a CAD constraint set, the software issues an error message. The error message identifies the bodies with missing geometry files and any unsupported constraints. You can import

the generated XML multibody description file into Simscape Multibody software, but the resulting model may not accurately represent the original CAD assembly model.

Importing a CAD Model

You import an XML multibody description file using the Simscape Multibody `smimport` function in its default import mode. The function parses the file and generates a Simscape Multibody model and associated data file. For step-by-step instructions on to import a CAD assembly model via its XML multibody description file, see "Import a CAD Assembly Model" (Simscape Multibody).

Note Starting with software version R2017b, the Simscape Multibody Link plug-in exports in an XML format compatible only with Simscape Multibody Second Generation software. You must import all such XML files using the `smimport` function. Models generated with this function comprise only second-generation blocks—those accessible by entering the command `sm_lib` at the MATLAB command prompt.

However, if you have any older XML files in a format compatible with Simscape Multibody First Generation software, you can continue to import them using the `mech_import` function. Models generated with this function comprise only first-generation blocks—those accessible by entering the command `mechlib` at the MATLAB command prompt.

CAD Import Errors

If a part geometry file is invalid or missing, the corresponding body cannot show in the Simscape Multibody visualization utility. If a CAD assembly model contains an unsupported constraint combination between bodies, Simscape Multibody software joins the bodies with a rigid connection. The rigid connection can take the form of a direct frame connection line, Rigid Transform block, or Weld Joint block.
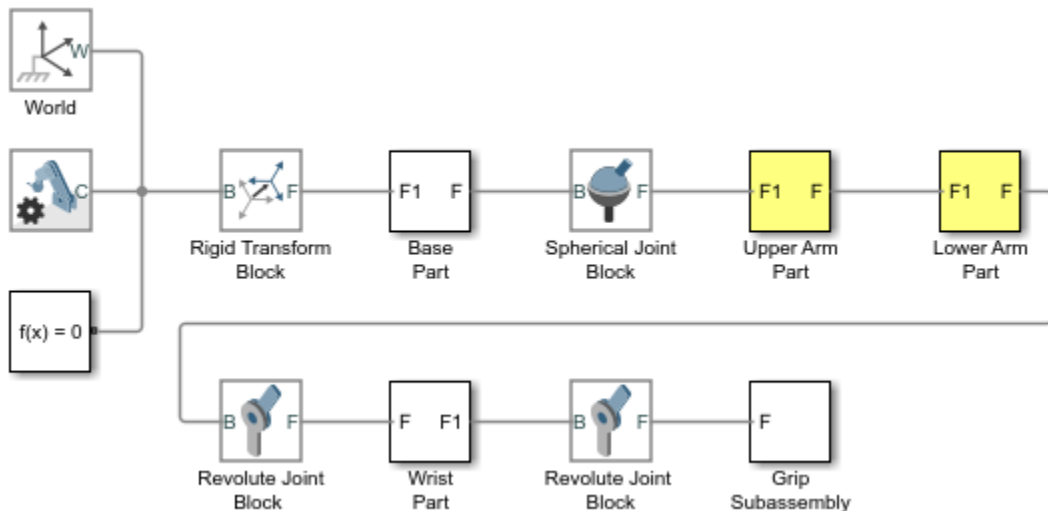
Rigid Connection Due to Unsupported Constraints

If Simscape Multibody software cannot translate a CAD constraint combination, it issues a warning message on the MATLAB command window identifying the affected bodies and their connection frames. For example:

```
Warning: The set of constraints between upperarm_1_RIGID and forearm_1_RIGID
could not be mapped to a joint. A rigid connection has been added between port F
of upperarm_1_RIGID and port F1 or forearm_1_RIGID for these constraints.
```

Simplifying Model Topology

You can import a CAD model with a simplified topology. So that you can do this, the smimport function provides the ModelSimplification argument. You can set this argument to:

- bringJointsToTop to group each set of rigidly connected parts into a new subsystem and promote all joints to the top level of the model hierarchy.

- groupRigidBodies to group rigidly connected parts into subsystems (and leave joints in their original places in the model hierarchy).

- None to import the model as is, without simplification.

2-9

Use the `bringJointsToTop` or `groupRigidBodies` option if your CAD model has many rigidly connected components, such as nuts and bolts, that you prefer to group together—for example, to more intuitively grasp the key components of the model at a glance of the block diagram.

Use the `bringJointsToTop` option if your CAD model has joints inside subassemblies and you prefer to expose them at the top level—for example, to work with joint actuation and sensing signals without having to search for the joints inside different subsystems.

Note that model simplification is available for CAD import only. URDF models have flat topologies with little need for simplification.

Updating an Existing Data File

You regenerate the data file for a previously imported model by running the `smimport` function in `dataFile` mode. You specify this mode using the optional `ImportMode` `Name,Value` pair argument. The function uses the prior data file to keep the mapping between structure array indices and blocks consistent.

Before regenerating a data file, you must export a new XML multibody description file from the updated CAD assembly model. The `smimport` function uses the data in the new multibody description file to generate the new data file.

The function does not update the block diagram when run in `dataFile` mode. If you add or delete bodies in the source CAD assembly model, you must manually add or delete the corresponding blocks in the previously imported model.
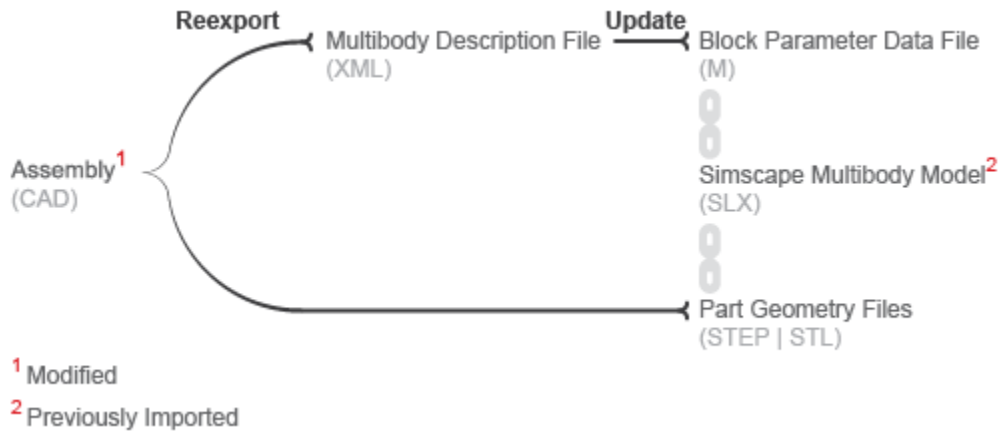
CAD Update

Export a CAD Assembly Model

Installing and Enabling the Plug-In

If you have not yet installed and enabled the Simscape Multibody Link plug-in on your device, before continuing see "Install the Simscape Multibody Link Plug-In" on page 1-5.

Accessing the CAD Export Menu

You can access the export menu from the CAD application menu bar whenever a CAD assembly model is open. The location of the menu can vary with the CAD software version but it is generally under **Add-Ins** for Autodesk Inventor software and under **Tools** for PTC Creo and SolidWorks software.

Opening a CAD Model Example

Your Simscape Multibody Link installation comes with a number of CAD assembly models that you can use as export examples. You can find the models in the folders:

matlabroot\toolbox\physmod\smlink\smlinkdemos*cadPlatform**modelFolder*

Replace the following as described:

- *matlabroot* — MATLAB root folder, for example, `C:\Programs\MATLAB\`. Use the `matlabroot` command at the MATLAB command prompt to determine your MATLAB root folder.

- *cadPlatform* is an identifier for your CAD application—`inventor` for Autodesk Inventor, `proe` for PTC Creo, and `sw` for SolidWorks.

- *modelFolder* is the model name or abbreviation—`robot` for a robotic arm model and `stewart` for a Stewart platform model (available only for SolidWorks and PTC Creo applications). Ignore the remaining folders.

For example, if your MATLAB root folder is `C:\Programs\MATLAB`, your CAD application is SolidWorks, and the model that you'd like to open is `robot`, then you can open the mode from the folder:

`C:\Programs\MATLAB\toolbox\physmod\smlink\smlinkdemos\sw\robot`

Export Model

1 Open the assembly model to export. Note that part models are not supported and that the Simscape Multibody Link export menu is not accessible if an assembly model is not open.

2 From the CAD export menu on page 2-12, select the option to export the model.

3 Specify the XML multibody description file name and folder. The Simscape Multibody Link plug-in generates the XML file and the part geometry files needed to render the model once imported.

After Export

Use the `smimport` function with the name of the XML multibody description file as an argument to import the CAD assembly into the Simscape Multibody modeling environment. The function parses the file and uses the data contained therein to generate a Simscape Multibody block diagram and an accompanying MATLAB data file. See "Import a CAD Assembly Model" (Simscape Multibody).

Warning This content refers to Simscape Multibody First Generation software. First-generation features are slated to be deprecated and should be avoided. To prevent compatibility issues in future releases, the Simscape Multibody Link plug-in no longer supports the translation of CAD models into Simscape Multibody First Generation models.

Troubleshoot CAD Export Issues

During CAD export, Simscape Multibody Link can encounter CAD translation issues that arise from unsupported CAD elements. The following issues are known.

Unsupported Constraints

If a CAD assembly contains one or more unsupported constraints or mates, the Simscape Multibody Link utility issues a warning message and creates a log file in the folder of the XML multibody description file. The warning message identifies the name of the log file; the log file identifies the unsupported CAD constraints. In the event a constraint warning occurs, review the log file and consider replacing the unsupported constraints or mates with supported equivalents.

The constraint warning does not stop the creation of the XML multibody description file. You can import the XML file into a new Simscape Multibody model, but the model does not accurately represent the original CAD assembly. During import, constraint warnings appear at the MATLAB command line.

For a list of supported constraints, see "Constraints and Joints".

Correct Constraint Issue

When you import a CAD assembly that contains an unsupported constraint, Simscape Multibody replaces the constraint with a rigid connection. The connection provides zero degrees of freedom between the connecting rigid body frames. To restore the original degrees of freedom between the rigid bodies frames, you must:

- In the CAD platform, replace each unsupported constraint with a supported equivalent. When you are finished, export the CAD assembly once again.
- In the imported Simscape Multibody model, manually replace each artificially introduced rigid connection with the appropriate joint or constraint block.

Note Replacing unsupported constraints with supported equivalents works in a limited number of cases. In certain cases, no adequate equivalent constraint or joint block exists.

3

Simscape Multibody Examples

Export a SolidWorks Robot Assembly Model

In this section...
"Example Requirements" on page 3-3
"Open the Assembly Model" on page 3-4
"Export the Model" on page 3-4
"Check the Exported Files" on page 3-5
"About the Example CAD Files" on page 3-5
"About CAD Export" on page 3-6

In this example, you export a SolidWorks CAD assembly that represents a robot arm. The export procedure generates one XML file and a set of geometry files that you can import into Simscape Multibody to generate a new model.

The example begins with a procedure to export the CAD assembly. Information on the robot CAD files and CAD Export follows the export procedure. To import the robot assembly into a Simscape Multibody model, see "Import a Robotic Arm CAD Model" (Simscape Multibody).

The following figure shows the robot CAD assembly you export in this example.
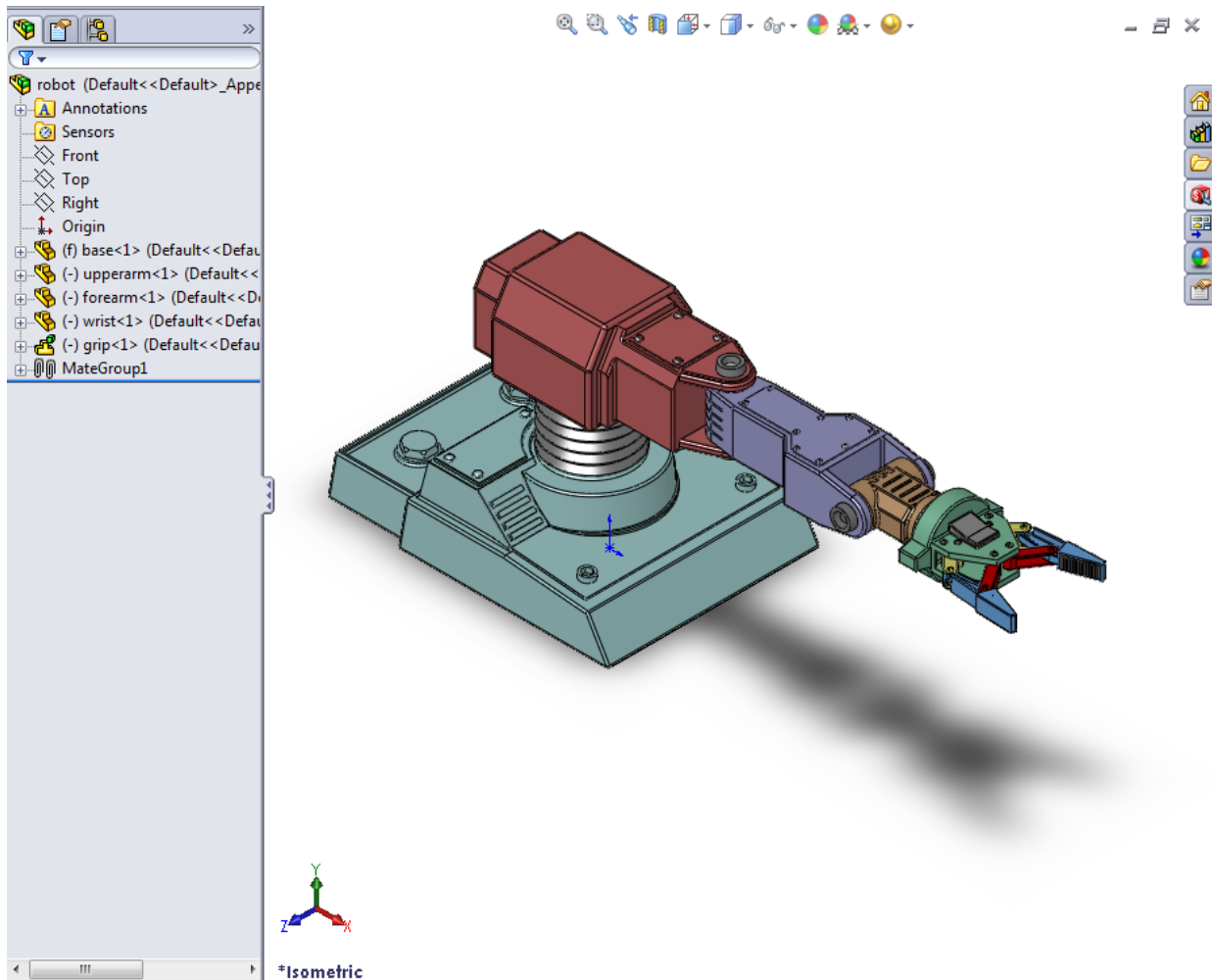
Example Requirements

To successfully complete this example, you must meet the following requirements:

- Have the latest version of Simscape Multibody Link installed on your machine.
- Have completed the linking procedure for your SolidWorks installation. The linking procedure adds a Simscape Multibody Link add-in to the SolidWorks installation.

- Have access to the robot example files that accompany the Simscape Multibody Link installation. See "Export a SolidWorks Robot Assembly Model" on page 3-2.

Open the Assembly Model

Before you can export the robot assembly, you must load the assembly into SolidWorks.

1   Open SolidWorks on your machine.

2   Select **File** > **Open**

3   Navigate to the file directory that contains the robot CAD files.

Note The directory that contains the robot CAD files for the SolidWorks platform is

```
<MATLAB Root>\toolbox\physmod\smlink\smlinkdemos\...
...solidworks\robot
```

---

4   Select file `robot.SLDASM`.

5   Click **Open**.

The CAD platform opens the robot assembly.

Export the Model

Once you successfully open the robot CAD assembly in your SolidWorks installation, you can export the assembly in a format compatible with the latest Simscape Multibody technology:

1   On the SolidWorks tool bar, select **Simscape Multibody Link** > **Export** > **Simscape Multibody**. In certain SolidWorks versions, this option may appear under the **Tools** menu.

2   In the **File name** field of the **Save As** dialog box, enter `sm_robot` and select a directory to export the files.

3   Click **Save**.

Note Large CAD assemblies require more time to complete the export process. Allow up to a few minutes for the export process to complete.

Check the Exported Files

Confirm the following files exist in the specified export directory:

*   XML file — provides structure of model and parameters of parts.
*   Geometry files — provides surface geometry of parts.

About the Example CAD Files

The CAD assembly files are present in your Simscape Multibody Link installation. You can access the files in the following directory:

```
<MATLAB Root>\matlab\toolbox\physmod\smlink\smlinkdemos\...
...solidworks\robot
```

Substitute <MATLAB Root> with the root directory of your MATLAB installation.

Note If you are not sure what your MATLAB root directory is, at the MATLAB command line enter `matlabroot`. MATLAB returns the root directory for your installation.

The `\robot` directory contains a set of CAD files that define each CAD part and CAD assembly. Part file names contain the file extension .SLDPRT. Assembly file names contain the extension .SLDASM. A drawing file with extension .SLDDRW contains robot arm dimensions.

The robot assembly contains nine parts and two assemblies: robot.SLDASM and grip.SLDASM. File robot.SLDASM models the robot root assembly. File grip.SLDASM models the robot grip subassembly.

The following table lists all files the example requires.

File Name	Type
robot.SLDASM	Assembly
grip.SLDASM	
wrist.SLDPR	Part
upperarm.SLDPRT	
secondfingerlink.SLDPRT	

File Name	Type
metacarples.SLDPRT	
firstfingerlinkL.SLDPRT	
forearm.SLDPRT	
firstfingerlink.SLDPRT	
fingertips.SLDPRT	
base.SLDPRT	

About CAD Export

The CAD export procedure generates one XML multibody description file and a set of geometry files. The XML file contains the structure of the assembly and the parameters that define each part. The geometry files define the 3-D geometry of each part. Once the export procedure is complete, you can import the XML multibody description file into Simscape Multibody software. Simscape Multibody uses the file to automatically generate a new Simscape Multibody model.

Export an Autodesk Inventor Robot Assembly Model

In this section...

In this example, you export an Autodesk Inventor CAD assembly that represents a robot arm. The export procedure generates one XML file and a set of geometry files that you can import into Simscape Multibody to generate a new s model.

The example begins with a procedure to export the CAD assembly. Information on the robot CAD files and CAD Export follows the export procedure. To import the robot assembly into a Simscape Multibody model, see "Import a Robotic Arm CAD Model" (Simscape Multibody).
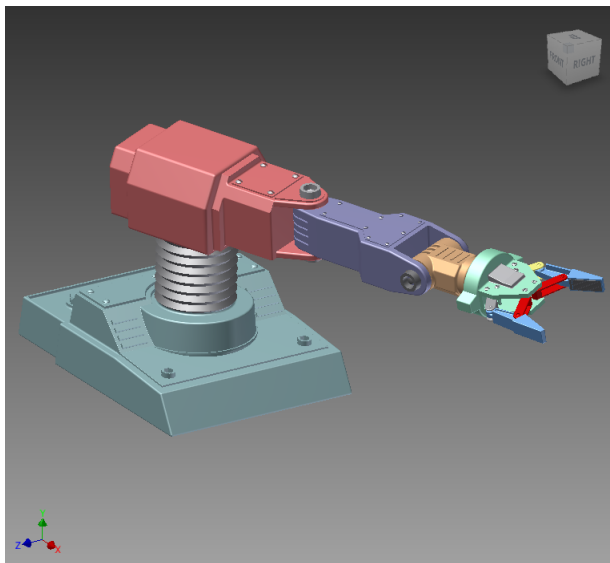
The Robot Assembly Model

Example Requirements

To successfully complete this example, you must have:

- Installed the latest Simscape Multibody Link version on your machine.
- Completed the linking procedure for your Inventor installation. The linking procedure adds a Simscape Multibody Link add-in to the Inventor installation.

Open the Assembly Model

Before you can export the robot assembly, you must load the assembly into Inventor.

1   Open Inventor on your machine.

2   Select **File** > **Open**

3   Navigate to the file directory that contains the robot CAD files.

> **Note** The directory that contains the robot CAD files for the Autodesk Inventor platform is
>
> ```
> <MATLAB Root>\toolbox\physmod\smlink\smlinkdemos\...
> ...inventor\robot
> ```

4   Select file `robot.IAM`.

5   Click **Open**.

The CAD platform opens the robot assembly.

Export the Model

Once you successfully open the robot CAD assembly in your Inventor installation, you can export the assembly in a format compatible with the latest Simscape Multibody technology:

1   In the Inventor toolbar, select **Add-Ins** > **Export** > **Simscape Multibody**.

2   In the **File name** field of the **Save As** dialog box, enter `sm_robot` and select a directory to export the files.

3   Click **Save**.

Note Large CAD assemblies require more time to complete the export process. Allow up to a few minutes for the export process to complete.

Check the Exported Files

Confirm the following files exist in the export directory you specified:

- XML file—Provides structure of model and parameters of parts.
- Geometry files—Provide surface geometry of parts.

About the Example CAD Files

The CAD assembly files are present in your Simscape Multibody Link installation. You can access the files in the following directory:

```
<MATLAB Root>\matlab\toolbox\physmod\smlink\smlinkdemos\...
...inventor\robot
```

Substitute <MATLAB Root> with the root directory of your MATLAB installation.

Note If you are not sure what your MATLAB root directory is, at the MATLAB command line enter `matlabroot`. MATLAB returns the root directory for your installation.

The `\inventor\robot` directory contains a set of CAD files that define each CAD part and CAD assembly. Part file names contain the file extension .IPT. Assembly file names contain the extension .IAM.

The robot assembly contains nine parts and two assemblies: robot.IAM and grip.IAM. File robot.IAM models the robot root assembly. File grip.IAM models the robot grip subassembly.

The following table lists all files the example requires.

File Name	Type
robot.IAM	Assembly
grip.IAM	
wrist.IPT	Part

File Name	Type
upperarm.IPT	
secondfingerlink.IPT	
metacarples.IPT	
firstfingerlinkL.IPT	
forearm.IPT	
firstfingerlink.IPT	
fingertips.IPT	
base.IPT	

About CAD Export

The CAD export procedure generates one XML multibody description file and a set of geometry files. The XML file contains the structure of the assembly and the parameters that define each part. The geometry files define the 3-D surface of each part. Once the export procedure is complete, you can import the XML multibody description file into Simscape Multibody software. Simscape Multibody uses the file to automatically generate a new Simscape Multibody model.

Export a PTC Creo Robot Assembly Model

| **In this section...** |
| --- |
| "Example Requirements" on page 3-11 |
| "Open the Assembly Model" on page 3-12 |
| "Export the Model" on page 3-12 |
| "Check the Exported Files" on page 3-13 |
| "About the Example CAD Files" on page 3-14 |
| "About CAD Export" on page 3-15 |

In this example, you export a Creo (Pro/ENGINEER®) CAD assembly that represents a robot arm. The export procedure generates one XML file and a set of geometry files that you can import into Simscape Multibody to generate a new model.

The example begins with a procedure to export the CAD assembly. Information on the robot CAD files and CAD Export follows the export procedure. To import the robot assembly into a Simscape Multibody model, see "Import a Robotic Arm CAD Model" (Simscape Multibody).

The following figure shows the robot CAD assembly that you export in this example.
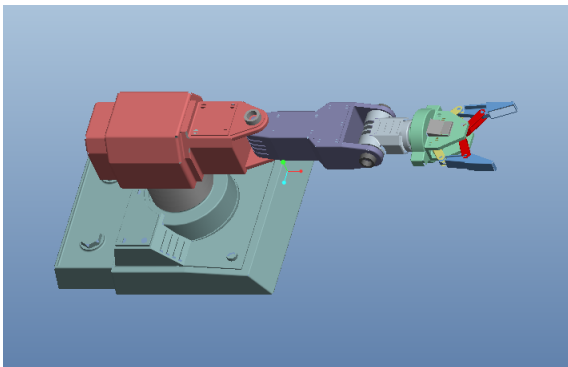
Example Requirements

To successfully complete this example, you must meet the following requirements:

- Have the latest version of Simscape Multibody Link installed on your machine.
- Have completed the linking procedure for your Creo installation. The linking procedure adds a Simscape Multibody Link add-on tool to the installation.
- Have access to the robot example files that accompany the Simscape Multibody Link installation.

Open the Assembly Model

Before you can export the robot assembly, you must load the assembly into Creo.

1 Open Creo on your machine.
2 Select **File** > **Open**
3 Navigate to the file directory that contains the robot CAD files.

Note The directory that contains the robot CAD files for the Pro/ENGINEER platform is

`<MATLAB Root>\toolbox\physmod\smlink\smlinkdemos\proe\robot`

---

4 Select file `robot.ASM`.
5 Click **Open**.

The CAD platform opens the robot assembly.

Export the Model

Once you successfully open the robot CAD assembly in your Creo installation, you can export the assembly in format:

1 In the Creo toolbar, click **Tools**.
2 Select **Simscape Multibody Link** > **Export** and click **Simscape Multibody** to export in a format compatible with the latest Simscape Multibody technology.
3 In the **File name** field of the **Select Folder** dialog box, enter select a directory to export the files into.

Note Do not enter a name in the **File name** field. The field should contain only a dot .

---

4   Click **Open**.

5   In the new dialog box, enter file name `sm_robot` and click the green arrow.

Note Simscape Multibody Link generates a new XML multibody description file and a set of geometry files that you can import into a model.

Check the Exported Files

Confirm the following files exist in the export directory you specified:

XML Multibody Description File

Name	Type	Description
sm_robot.xml	XML multibody description file	The XML file defines the structure of the CAD assembly. The file also contains the parameters required to model each part in the CAD assembly.

Geometry Files

Note In the **Name** column, <identifier> is a set of numeric and alphabetic characters that identifies each file.

Name	Type	Description
base_prt	Geometry files	Provide the 3-D surface shapes of the CAD parts
fingertips_prt		
firstfingerlink_prt		
firstfingerlinkl_prt		
forearm_prt		
metacarples_prt		
secondfingerlink_prt		

Name	Type	Description
upperarm_prt		
wrist_prt		

About the Example CAD Files

The CAD assembly files are present in your Simscape Multibody Link installation. You can access the files in the following directory:

```
<MATLAB Root>\matlab\toolbox\physmod\smlink\smlinkdemos\...
...proe\robot
```

Substitute <MATLAB Root> with the root directory of your MATLAB installation.

Note If you are not sure what your MATLAB root directory is, at the MATLAB command line enter `matlabroot`. MATLAB returns the root directory for your installation.

The `\proe\robot` directory contains a set of CAD files that define each CAD part and CAD assembly. Part file names contain the file extension .PRT. Assembly file names contain the extension .ASM.

The robot assembly contains nine parts and two assemblies: robot.ASM and grip.ASM. File robot.ASM models the robot root assembly. File grip.ASM models the robot grip subassembly.

The following table lists all files the example requires.

File Name	Type
robot	Assembly
grip	
wrist	Part
upperarm	
secondfingerlink	
metacarples	
firstfingerlinkL	

File Name	Type
forearm	
firstfingerlink	
fingertips	
base	

About CAD Export

The CAD export procedure generates one XML multibody description file and a set of geometry files. The XML file contains the structure of the assembly and the parameters that define each part. The geometry files define the 3-D surface shapes of the CAD parts. Once the export procedure is complete, you can import the XML multibody description file into Simscape Multibody. Simscape Multibody uses the file to automatically generate a new Simscape Multibody model.

Export a Stewart Platform from SolidWorks Software

In this example, you export a SolidWorks CAD assembly that represents a Stewart platform. The export procedure generates one XML file and a set of geometry files that you can import into Simscape Multibody to generate a new model.

The example begins with a procedure to export the CAD assembly. Information on CAD files and CAD Export follows the export procedure. To import the robot assembly into a Simscape Multibody model, see "Import a Robotic Arm CAD Model" (Simscape Multibody).

The following figure shows the Stewart platform assembly you export in this example.

Example Requirements

To successfully complete this example, you must meet the following requirements:

- Have the latest version of Simscape Multibody Link installed on your machine.
- Have completed the linking procedure for your SolidWorks installation. The linking procedure adds a Simscape Multibody Link add-in to the SolidWorks installation.
- Have access to the Stewart Platform example files that accompany the Simscape Multibody Link installation. See "About the Example CAD Files" on page 3-19.

Open the Assembly Model

Before you can export the robot assembly, you must load the assembly in a SolidWorks session.

1   Open SolidWorks on your machine.
2   Select **File** > **Open**
3   Navigate to the file directory that contains the robot CAD files.

> **Note** The directory that contains the robot CAD files for the SolidWorks platform is
>
> ```
> <MATLAB Root>\toolbox\physmod\smlink\smlinkdemos\...
> ...solidworks\stewart
> ```

4   Select file `stewart_platform.SLDASM`.
5   Click **Open**.

The CAD platform opens the Stewart platform assembly.

Export the Model

Once you successfully open the CAD assembly in your SolidWorks installation, you can export the assembly in a format compatible with the latest Simscape Multibody technology:

1   In the SolidWorks toolbar, select **Simscape Multibody Link** > **Export** and click **Simscape Multibody** . In certain SolidWorks versions, this option may appear under the **Tools** menu.
2   In the **File name** field of the **Save As** dialog box, enter `sm_stewart_platform` and select a directory to export the files.
3   Click **Save**.

> **Note** Large CAD assemblies require more time to complete the export process. Allow up to a few minutes for the export process to complete.

You can proceed to import the robot assembly into a Simscape Multibody model. See "Import a Robotic Arm CAD Model" (Simscape Multibody).

Check the Exported Files

Confirm the following files exist in the specified export directory:

XML Multibody Description File

Name	Type	Description
sm_stewart_platform.xml	XML multibody description file	Provides the assembly structure and part parameters that define the CAD assembly

Geometry Files

Name	Type	Description
BaseRing_Default_sldprt	Geometry files	Provides the 3-D surface shapes of the various CAD parts
Bearing_Block_Default_sldprt		
Carrier_Block_Default_sldprt		
CenterBlock_Default_sldprt		
CeramicStrip5010_Default_sldprt		
Clevis_pin_A_3x6_Default_sldprt		
Cylinder_Head_Cap_Screw_M3x10_Default_sldprt		
Cylinder_Head_Cap_Screw_M3x8_Default_sldprt		
DialPlate2_Default_sldprt		

Name	Type	Description
GratingStrip5010_Default_sldprt		
HR_1_Motor_Default_sldprt		
Hex_Nut_M5_Default_sldprt		
Hexagon_Socket_Button_Head_Screw_M3x6_Default_sldprt		
Hexagon_Socket_Head_Cap_Screw_M3x5_Default_sldprt		
Hexagon_Socket_Set_Screw_M3x3_Default_sldprt		
MPB_C345MB_Default_sldprt		
RGH25_Default_sldprt		
Recessed_Pan_Head_Screw_M2x8_48_Z_Default_sldprt		
RenishawMount_Default_sldprt		
SV2075_Default_sldprt		
ShaftStop_Default_sldprt		
Spider_Default_sldprt		
Threaded_Shaft_Default_sldprt		
Yoke_Default_sldprt		
pin2_Default_sldprt		
stewart_platform		

About the Example CAD Files

The CAD assembly files are present in your Simscape Multibody Link installation. You can access the files in the following directory:

```
<MATLAB Root>\matlab\toolbox\physmod\smlink\smlinkdemos\...
...solidworks\stewart
```

Substitute <MATLAB Root> with the root directory of your MATLAB installation.

Note If you are not sure what your MATLAB root directory is, at the MATLAB command line enter `matlabroot`. MATLAB returns the root directory for your installation.

The `\stewart` directory contains a set of CAD files that define each CAD part and CAD assembly. Part file names contain the file extension .SLDPRT. Assembly file names contain the extension .SLDASM.

About CAD Export

The CAD export procedure generates one XML multibody description file and a set of geometry files. The XML file contains the structure of the assembly and the parameters that define each part. The geometry files define the 3-D surface shapes of the various CAD parts. Once the export procedure is complete, you can import the XML multibody description file into Simscape Multibody software. Simscape Multibody uses the file to automatically generate a new Simscape Multibody model.

Export a Stewart Platform from Creo Software

In this section...

In this example, you export a Stewart platform assembly from a Creo (Pro/ENGINEER) CAD platform. The export procedure generates one XML file and a set of geometry files that you can import into Simscape Multibody to generate a new model.

The example begins with a procedure to export the CAD assembly. Information on CAD files and CAD Export follows the export procedure. To import the robot assembly into a Simscape Multibody model, see "Import a Robotic Arm CAD Model" (Simscape Multibody).

The following figure shows the Stewart platform assembly you export in this example.

Example Requirements

To successfully complete this example, you must meet the following requirements:

• Have the latest version of Simscape Multibody Link installed on your machine.

• Have completed the linking procedure for your Creo installation. The linking procedure adds a Simscape Multibody Link add-in to the Creo installation.

• Have access to the Stewart Platform example files that accompany the Simscape Multibody Link installation. See "About the Example CAD Files" on page 3-25.

Open the Assembly Model

Before you can export the robot assembly, you must load the assembly in a Creo session.

1 Open Creo on your machine.

2 Select **File** > **Open**

3 Navigate to the file directory that contains the robot CAD files.

Note The directory that contains the robot CAD files for the Creo platform is

`<MATLAB Root>\toolbox\physmod\smlink\smlinkdemos\proe\stewart`

---

4 Select file `stewart_platform.ASM`.

5 Click **Open**.

The CAD platform opens the Stewart platform assembly.

Export the Model

Once you successfully open the CAD assembly in your Creo installation, you can export the assembly in format:

1 In the Creo toolbar, select **Simscape Multibody Link** > **Export** and click **Simscape Multibody**.

2 In the **File name** field of the **Select Folder** dialog box, enter select a directory to export the files into.

Note Do not enter a name in the **File name** field. The field should contain only a dot **.**

---

3 Click **Open**.

4 In the new dialog box, enter file name `sm_stewart_platform` and click the green arrow.

Note Simscape Multibody Link generates a new XML multibody description file and a set of geometry files that you can import into a model.

You can proceed to import the robot assembly into a Simscape Multibody model. The import model assumes the XML multibody description file you generated in this example has the name `sm_stewart_platform.xml`. If the file has a different name, change the name to `sm_stewart_platform` before proceeding. See "Import a Robotic Arm CAD Model" (Simscape Multibody).

Check the Exported Files

Confirm the following files exist in the specified export directory:

XML Multibody Description File

Name	Type	Description
sm_stewart_platform	XML multibody description file	Provides the assembly structure and part parameters that define the CAD assembly

Geometry Files

Name	Type	Description
ai_f100128_prt	Geometry files	Provides the 3-D surface shapes of the various CAD parts
basering_prt		
bearing_block_prt		
carrier_block_prt		
centerblock_prt		

Name	Type	Description
ceramicstrip5010_prt		
clevis_pin_a_3x6_prt		
cylinder_head_cap_screw_m3x8_prt		
cylinder_head_cap_screw_m3x10_prt		
dialplate2_prt		
gratingstrip5010_prt		
hex_nut_m5_prt		
hexagon_socket_button_head_scre_prt		
hexagon_socket_head_cap_screw_m_prt		
hexagon_socket_set_screw_m3x3_prt		
hr_1_motor_prt		
mpb_c345mb_prt		
pin2_prt		
recessed_pan_head_screw_m2x8_48_prt		
renishawmount_prt		
rgh25_prt		
shaftstop_prt		
spider_prt		
sv2075_prt		
threaded_shaft_prt		
yoke_prt		

About the Example CAD Files

The CAD assembly files are present in your Simscape Multibody Link installation. You can access the files in the following directory:

```
<matlabroot>\matlab\toolbox\physmod\smlink\smlinkdemos\...
...proe\stewart
```

Substitute <matlabroot> with the root directory of your MATLAB installation.

Note If you are not sure what your MATLAB root directory is, at the MATLAB command line enter `matlabroot`. MATLAB returns the root directory for your installation.

The `\stewart` directory contains a set of CAD files that define each CAD part and CAD assembly. Part file names contain the file extension .PRT. Assembly file names contain the extension .asm.

About CAD Export

The CAD export procedure generates one XML multibody description file and a set of geometry files. The XML file contains the structure of the assembly and the parameters that define each part. The geometry files define the 3-D geometry of each part. Once the export procedure is complete, you can import the XML multibody description file into Simscape Multibody software. Simscape Multibody uses the file to automatically generate a new Simscape Multibody model.

4

Custom Linking to Third-Party Applications

The Simscape Multibody Link software includes an application programming interface (API). With the API of an external application program and the Simscape Multibody Link API, you can selectively transfer data from the external application to the Simscape Multibody Link software.

Custom Export with Simscape Multibody Link API

In this section...
"About Custom CAD Export" on page 4-2
"Custom Translation Steps in Common with Standard Export" on page 4-3
"Custom Translation Steps Different from Standard Export" on page 4-4
"Requirements for Creating a Custom Exporter" on page 4-4

Warning This content is specific to Simscape Multibody First Generation software. First-generation features are slated to be deprecated and should be avoided.

About Custom CAD Export

The translation process from an externally defined machine representation to a Simscape Multibody model is the same whether you use the *standard* export with a supported external third-party platform or create your own *custom* exporter. The Simscape Multibody Link exporter translates mechanical system data from an external application, such as a computer-aided design (CAD) platform. You can use this translated data to generate a Simscape Multibody model of your original mechanical system.
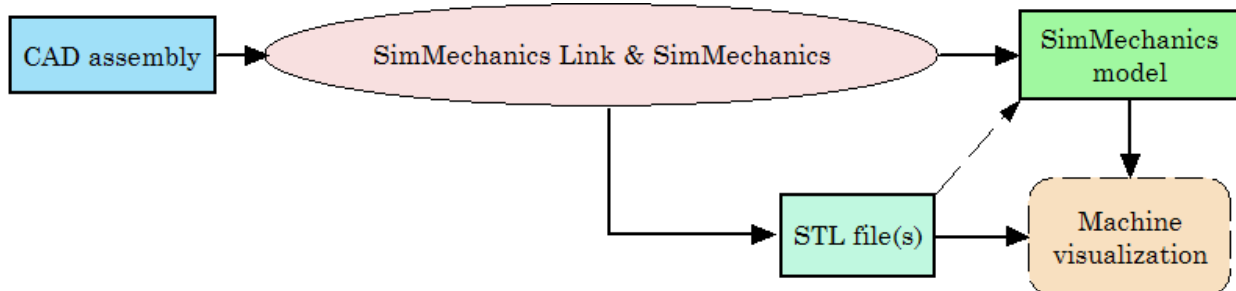
Reasons for Custom CAD Export

You must create and use your own custom exporter when:

- You want to export an assembly from a CAD platform that the Simscape Multibody Link utility does not support.

- The standard export from a supported CAD platform does not yield the results that you want.

Prerequisites for Custom CAD Export

CAD translation includes CAD assembly export and Simscape Multibody model import. Export requires:

- A CAD platform or application, including access to its application programming interface (API)
- MATLAB installed and registered as a server
- The Simscape Multibody Link utility, which includes its own API
- A *custom exporter module* that you create and that transfers assembly information from the CAD platform API to the Simscape Multibody Link API

Import requires Simscape Multibody software.

Custom Translation Steps in Common with Standard Export

You generate Simscape Multibody models from XML multibody description files. You use mechanical import and then visualize the models with geometry files in STEP or STL format. *Custom* export creates an XML file to represent a CAD assembly and a set of geometry files to represent the surface geometries of the assembly bodies. This part of CAD translation is the same as *standard* export.
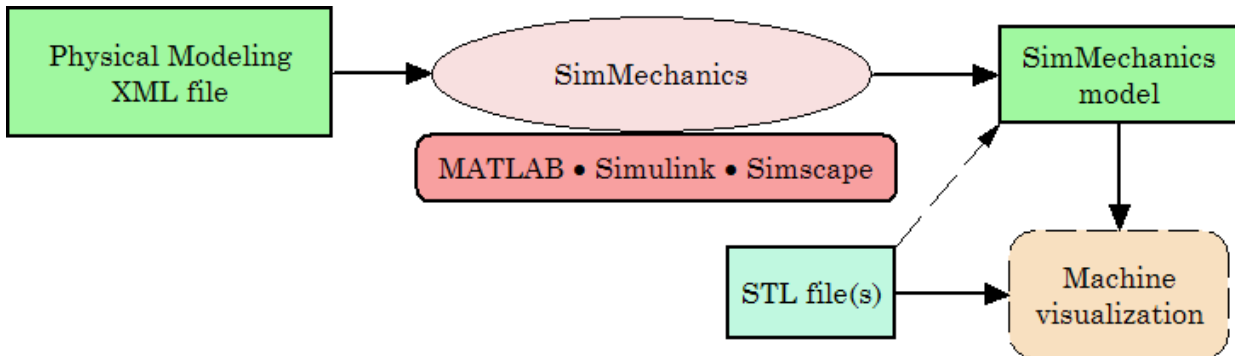
From an XML multibody description file to a Simscape Multibody Model

Custom Translation Steps Different from Standard Export

For *custom* export, you must create a custom exporter module that interacts with the APIs of both the CAD platform and the Simscape Multibody Link utility. From a CAD assembly, this custom exporter module creates a selective, intermediate representation of the machine that persists for one session. The module then finishes by creating the same files as the standard export does:

- An XML multibody description file representing selected data required to generate a Simscape Multibody model, which is written from the selective representation

- A set of geometry files to represent the surface shapes of the assembly bodies
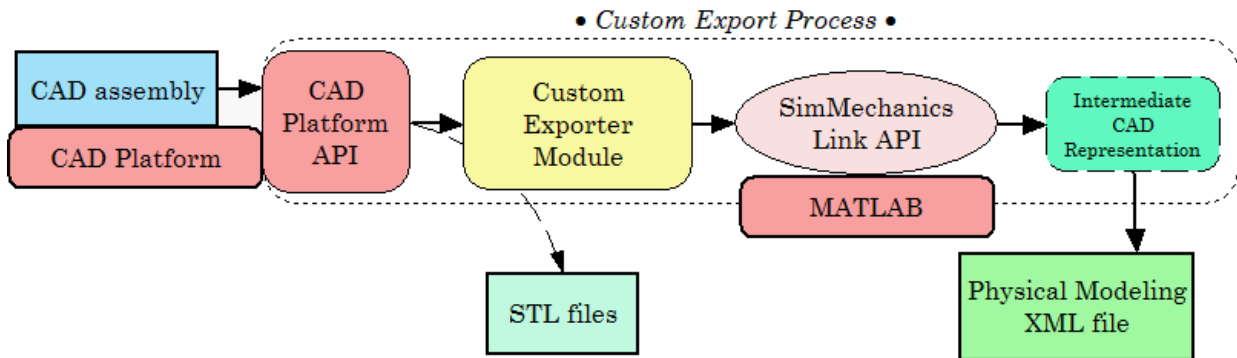
Custom Export: From a CAD Assembly to an XML Multibody Description File

Requirements for Creating a Custom Exporter

Note The Simscape Multibody Link API is supported on all platforms that MATLAB supports.

To create a custom exporter:

- Access the API of your CAD platform and understand how to call it from an external program. See your CAD platform documentation.

- Access the Simscape Multibody Link API and understand how to call it from an external program.

- Write the custom exporter module in C/C++.

  The module might be an executable or a linked library, depending on your CAD platform requirements and API.

For more information, see "Custom Translation into an XML Multibody Description File" on page 4-6

Custom Translation into an XML Multibody Description File

In this section...
"Mapping API Objects from CAD to XML" on page 4-6
"Selecting CAD Assembly Data for Export" on page 4-8
"Constructing Intermediate API Representations" on page 4-8
"Converting Selective API Representations into XML" on page 4-10

Warning This content is specific to Simscape Multibody First Generation software. First-generation features are slated to be deprecated and should be avoided.

Mapping API Objects from CAD to XML

A complete CAD assembly contains information both relevant and not relevant for exporting an XML multibody description file to represent your assembly.
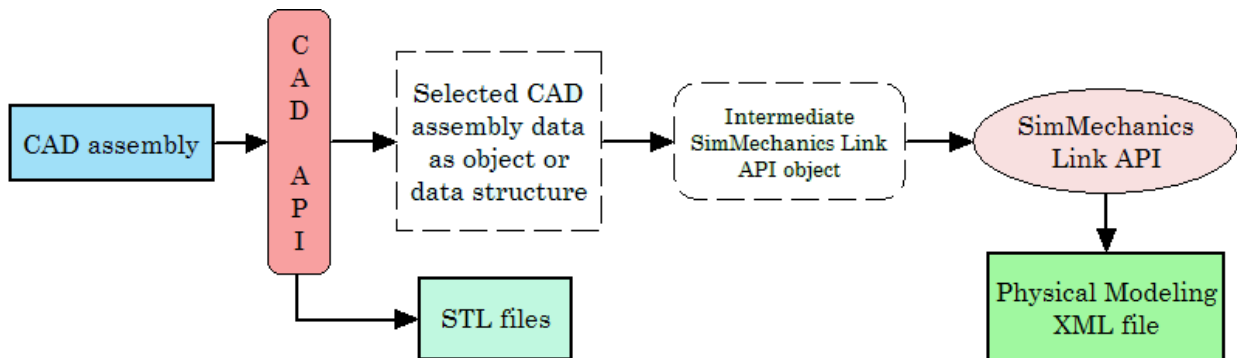
For detailed information on the design of a custom export module, see section "Design Custom Exporter Module" on page 4-11.

Data Required from a CAD Assembly to Create a Simscape Multibody Model

You obtain the selected assembly data through the CAD platform application programming interface (API) in the form of an object or a data structure. The data required from an assembly to construct a Simscape Multibody model include:

Mapping of Selected Mechanical Data to Simscape Multibody Model Components

Data Selected from CAD Assembly or Other External Machine Definition Mapped to...	...Required Simscape Multibody Model Component
Assembly and parts origin	Ground and World coordinate system
Assembly and subassembly hierarchy	Model and subsystem hierarchy
Part masses and inertia tensors, colors, and body geometry file names	Bodies, including their mass properties, geometries, and colors
Constraint restrictions on relative positions and motions of parts	Joints between pairs of Bodies Body coordinate systems connected to Joints

Using the Exporter Functions to Complete the Mapping of CAD to XML

Refer to the table Mapping of Selected Mechanical Data to Simscape Multibody Model Components. Using your CAD exporter module, you transform the selected data listed in the first column of the table into the form required in the second column with the Simscape Multibody Link API functions and data types. You collect the selected data into an intermediate Simscape Multibody Link API object. With the Simscape Multibody Link API, you then write the intermediate API representation to an XML multibody description file.

See "Design Custom Exporter Module" on page 4-11 for information on these API functions and data types.

Body Geometry Files Exported Directly from CAD API

For each moving Body in the model, the final Simscape Multibody model requires a separate body geometry file in STEP or STL format. You export these body geometry files directly from the CAD API, with file names matching the body geometry file names specified in the exported XML file. You specify these file names in the Simscape Multibody Link API object.

Tip You need body geometry files only for individual moving CAD parts or rigid subassemblies, not for flexible subassemblies.

Selecting CAD Assembly Data for Export

Tracing the Assembly Hierarchy: Nodes and Components

The assembly data that you need to retrieve through the CAD API starts with the assembly-subassembly hierarchy, with nodes. Each node in the hierarchical tree is an assembly *component* (a part or a subassembly).

For an individual component, the next component immediately up in the hierarchy is its *parent*. All dependent components connected below in the hierarchy are its *children*. The top parent in the assembly hierarchy is the whole assembly itself.

Identifying and Extracting Component Information

For each component, determine:

- Its geometric transformation with respect to its parent, its mass, its inertia tensor, its body geometry and color (for a part, or for a rigid subassembly exported as a single rigid body)
- The constraints that restrict how its children can move with respect to each other
- Whether or not the component is rigid or flexible; that is, whether all its children are to be treated as a single rigid body or as individual moving bodies
- Whether or not the component is *fixed*; that is, whether it is rigid or moving with respect to its parent

Constructing Intermediate API Representations

Before you can export the CAD assembly, you must construct a selective intermediate CAD representation, a collection of objects that capture the required CAD data.

Objects Required for Intermediate Representations

- *CAD models* (not to be confused with CAD assemblies or Simscape Multibody models). These represent assemblies, subassemblies, and parts.
- CAD model references
- Components (parts or subassemblies)
- Constraints
- A translator object constructed from all the other objects

Putting Objects Together into Intermediate Representations

To construct a full CAD representation:

1   Represent the entire assembly with a CAD model object.

2   Represent child parts and subassemblies with additional CAD model objects.

   If a subassembly is flexible (its parts can move with respect to each other), the subassembly is a parent to child parts, represented by their own CAD model objects.

3   Add child CAD model reference objects to their parent CAD model objects, including parent-to-child transforms.

   You might need to repeat steps 1 through 3 recursively until you have mapped the entire CAD assembly hierarchy.

4   Represent constraints between components with constraint objects. These are also children to parent assembly and subassembly objects.

5   Form a single translator object from all these objects, referenced by one another in a hierarchy that parallels the original assembly hierarchy.
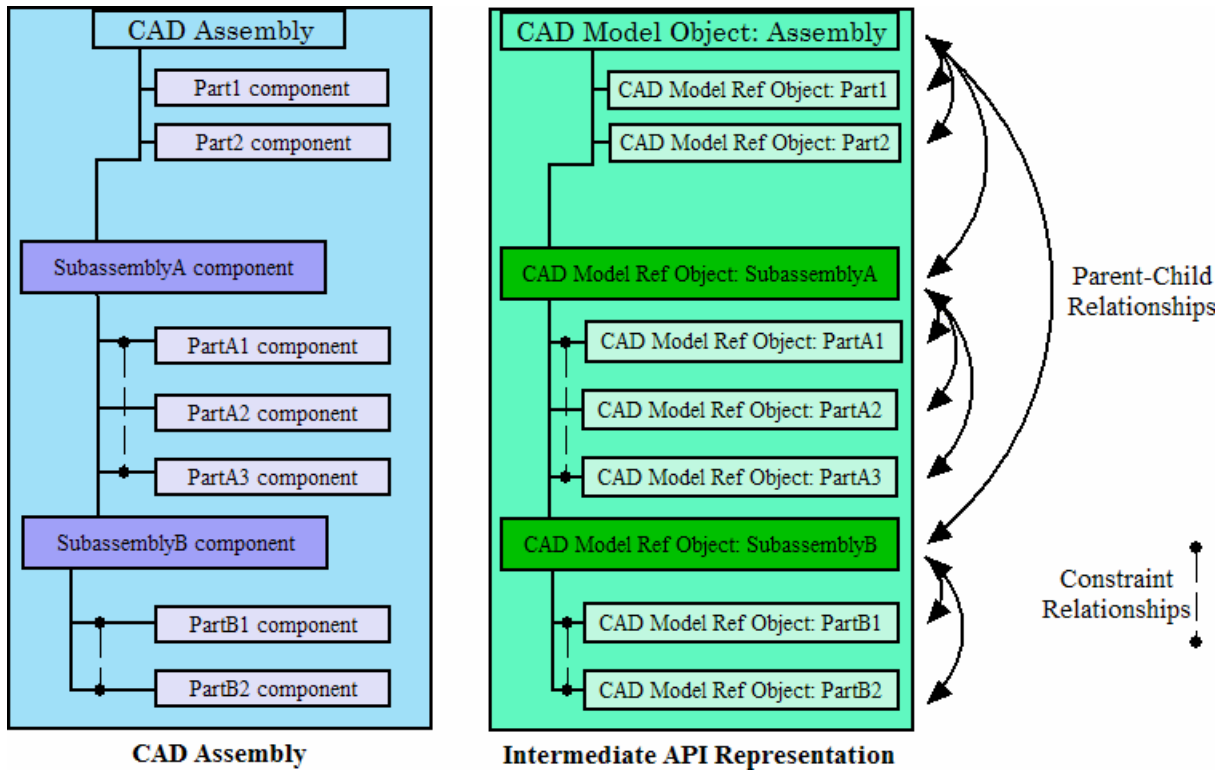
CAD Assembly and Intermediate API Representation: Parallel Hierarchies

Converting Selective API Representations into XML

The final translator object is the last intermediate form of the CAD assembly translation. From this translator object, you create the XML multibody description file representing the assembly.

Design Custom Exporter Module

| **In this section...** |
|---|
| "Prerequisites for Custom Exporter Modules" on page 4-11 |
| "Implementing Translation with CAD and Simscape Multibody Link APIs" on page 4-12 |

Warning This content is specific to Simscape Multibody First Generation software. First-generation features are slated to be deprecated and should be avoided.

Prerequisites for Custom Exporter Modules

A custom exporter module works with intermediate representations of CAD assembly data. For an overview of the types of CAD assembly and Simscape Multibody Link data and their relationship, see "Custom Translation into an XML Multibody Description File" on page 4-6.

A custom exporter module:

- Issues function calls to the APIs of both the CAD platform and the Simscape Multibody Link utility.
- Transfers assembly representation data from the assembly, through the CAD API, to the XML multibody description file, through the Simscape Multibody Link API.
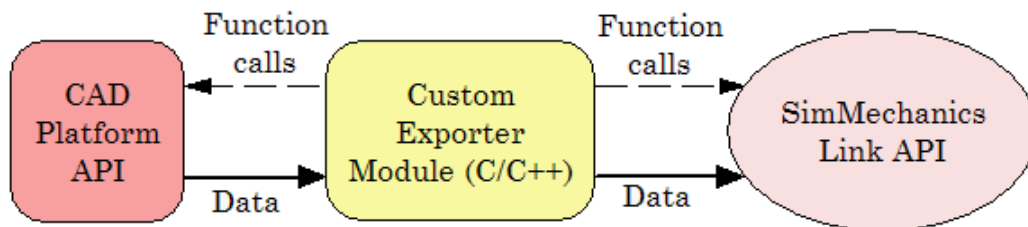
Custom Exporter Module Communicates with APIs (Detail)

Using the Simscape Multibody Link API Functions

The Simscape Multibody Link API is a library of API functions that you call to construct a unified, selective representation of an assembly and write it as an XML file. "Program

Custom Exporter with Simscape Multibody Link API" on page 4-15 describes how to create, compile, and execute custom exporter modules in C/C++ with the Simscape Multibody Link API function library.

Implementing Translation with CAD and Simscape Multibody Link APIs

Extracting Selective CAD Assembly Data

To extract the selected assembly data required for export, consult your CAD platform API documentation and determine which functions of the CAD platform API you need to accomplish this.

Constructing the Intermediate API Representation

To construct the intermediate representation of an assembly, use the following functions from the Simscape Multibody Link API, in the order shown. The API also contains other functions you might need in special cases. For more information, consult the Simscape Multibody Link Reference documentation.

Step	To...	Use Simscape Multibody Link API Function...	...and Simscape Multibody Link API Objects
1.	Set length and mass units for CAD assembly. The defaults are meters (m) and kilograms (kg), respectively.	`pmit_set_units`	—
2.	a. Create CAD model object to contain data for CAD assembly	`pmit_create_cadmodel`	PmitCadModelH
	b. Create API representation translator object	`pmit_create_cad2sm`	PmitCad2SMH
3.	Set translational, rotational, and numerical tolerances for CAD assembly	`pmit_set_tolerances`	PmitCad2SMH

Step	To...	Use Simscape Multibody Link API Function...	...and Simscape Multibody Link API Objects
4.	a. Create object to contain data for CAD subassemblies and parts	`pmit_create_cadmodel`	`PmitCadModelH`
	b. Create reference to CAD model object	`pmit_create_cadmodelref`	`PmitCadModelH,` `PmitCadModelRefH`
	c. Add reference within existing CAD model object to child model object by adding transform	`pmit_add_refincadmodel`	`PmitCadModelH,` `PmitCadModelRefH`
5.	a. Create object to contain data for CAD assembly component (part or rigid subassembly)	`pmit_create_assemcomp`	`PmitAssemCompH`
	b. Add reference within existing CAD model object to child assembly component object	`pmit_add_refincomp`	`PmitAssemCompH,` `PmitCadModelRefH`
6.	a. Create object to contain data for constraint between CAD components (parts or rigid subassemblies)	`pmit_create_constrain`	`PmitAssemCompH,` `PmitConstrainH,` `PmitConstrainType,` `PmitGeomType`
	b. Add constraint object to CAD model object	`pmit_add_constrain`	`PmitCadModelH,` `PmitConstrainH`

Export Intermediate API Representation into XML

To export the selective representation of your assembly into an XML multibody description file, use the following functions from the Simscape Multibody Link API, in the order shown.

Step	To...	Use Simscape Multibody Link API Function...	...and Simscape Multibody Link API Objects
1.	Enable the translation of CAD assembly data into a Simscape Multibody model	`pmit_create_cad2sm`	`PmitCad2SMH`
2.	Write an XML multibody description file from selective CAD representation of assembly	`pmit_write_xml`	`PmitCad2SMH`

For detailed information on the programming of a custom export module with the Simscape Multibody Link API, see "Program Custom Exporter with Simscape Multibody Link API" on page 4-15

Program Custom Exporter with Simscape Multibody Link API

In this section...
"Including, Linking to, and Calling the API Function Library" on page 4-15
"Locating API Code Examples" on page 4-16
"A Custom Exporter Module Example" on page 4-16

Warning This content is specific to Simscape Multibody First Generation software. First-generation features are slated to be deprecated and should be avoided.

Including, Linking to, and Calling the API Function Library

In the following procedures, replace:

- *matlabroot* with the root of your MATLAB installation.
- *ARCH* with the specific operating system architecture abbreviation for your system (for example, `win64` for 64-bit Windows).

Including and Using the API Header File

To write your C/C++ custom exporter module, use the C header file located in *matlabroot*/toolbox/physmod/smlink/api/include/.

This header file contains the function definitions that you follow to call the Simscape Multibody Link API functions from your module. Include this header file in your module C/C++ source code.

Compiling and Linking the Custom Exporter Module

In addition to linking your custom module to the Simscape Multibody Link API, consult your CAD platform's API documentation to determine requirements for linking to the platform's API.

On Windows Platforms

After you compile your module, link it to the binary API function library located in *matlabroot*\toolbox\physmod\smlink\api\lib\.

On UNIX, LINUX, and Mac Platforms

After you compile your module, link it to the binary API function library:

matlabroot/bin/*ARCH*/libmwpmi_api.*OS-SPECIFIC-EXTENSION*

OS-SPECIFIC-EXTENSION is the API file extension specific to your operating system.

Executing the Custom Exporter Module

To determine if you need to include your CAD platform API on the path, consult your CAD platform API documentation.

On Windows

Before you start execution of the module, verify that the folder *matlabroot*\bin*ARCH*\ is on the path.

On UNIX, LINUX, and Mac Platforms

Before you start execution of the module, verify that the folder *matlabroot*/bin/*ARCH*/ is included in the system path environment variable LD_LIBRARY_PATH.

Locating API Code Examples

You can find API examples in this folder:

matlabroot/toolbox/physmod/smlink/api/example/

The subfolder, cadapi_example/, contains CAD-based examples.

A Custom Exporter Module Example

The folder *matlabroot*/toolbox/physmod/smlink/api/example/ cadapi_example/ contains a simple C++ example of a custom module based on the API, cadapi_example.cpp.

- The example custom module converts two CAD parts with one constraint into two Simscape Multibody bodies and one joint and then writes the result to an XML file.
- The example program defines the CAD assembly data internally, rather than taking the data from a CAD platform through the platform API. Compared to the figure "Custom Exporter Module Communicates with APIs (Detail)" on page 4-11, the leftmost portion of the diagram is missing.

- To extend the example module to process real assembly data, add code that calls a CAD platform's API for assembly data to replace the internally defined data.