How to Create a
Component Assembly in CyPhy

Introduction

This document guides a reader through the process of making a simple component assembly in CyPhy. Three models are used: a Mass, a Spring, and a Damper. These three models will be connected to make a component assembly, referred to in this document as a MassSpringDamper.

This document is the **part 1** in a series of **three educational documents**. The second document leads the reader through making a test bench. The third document walks through the use of the DESERT Tool to explore a design space by comparing results between different assemblies.

Key vocabulary:

A **component** is an individual model in CyPhy.

A **component assembly** is a collection of models in CyPhy that interact with each other as a unit.

A **Components folder** is a type of folder that is designed to hold components and other general component-related folders.

A **Component Assembly Folder** is a type of folder that is designed to hold component assemblies.

A **Parameter** is a value in CyPhy given to a component that is meant to be edited (i.e. the fuel flow on a carburetor.)

A **Property** is a value in CyPhy given to a component that is not meant to be edited. (i.e. the material of a block).

A **port** is an interface on a component that is used to connect the component to other components.

The **SolidModeling** aspect holds CAD models in the CyPhy language.

The **Dynamics** aspect holder Modelica models in the CyPhy language.

System Prerequisites:

The tutorial uses OpenModelica version 1.8 and the 3.2 Modelica Standard Library.

Updating Modelica Standard Library:

Verify that OpenModelica is utilizing the 3.2 library by **clicking Tools>Options.** In the pop up window, select libraries. **Select file named Modelica and click Edit**. Ensure that the value associated with this file is 3.2. Your OpenModelica library options should appear as shown below.
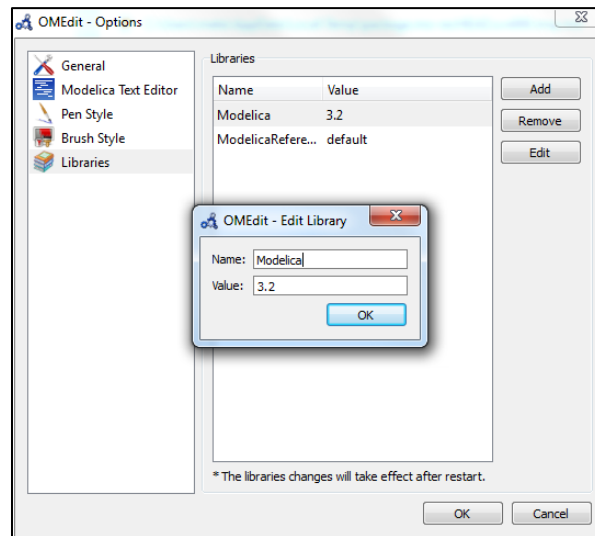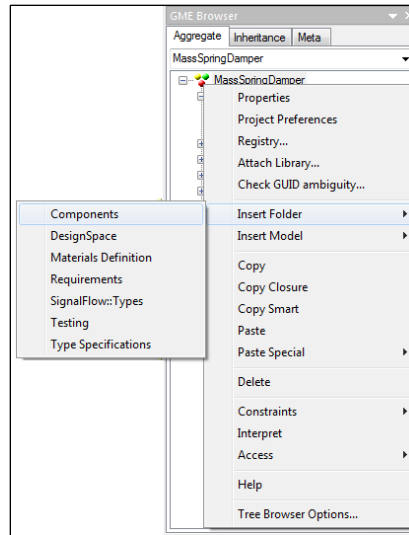

Procedure

Create Folders and Create a Component Assembly

Step 1: Creating a Component Folder

The first step in creating an assembly in GME is to insert a new component folder in the GME Browser. **Right-click on the GME Browser and select Insert Folder > Components**. **Name this folder "Component Assemblies".**

Step 2: Creating a Component Assembly Folder

To create an assembly folder in GME, insert a new component assembly folder in the GME Browser. **Right-click on your newly created component folder named "Component Assemblies" and select Insert Folder > Component Assemblies. Name this folder "My Mass Spring Damper ".**
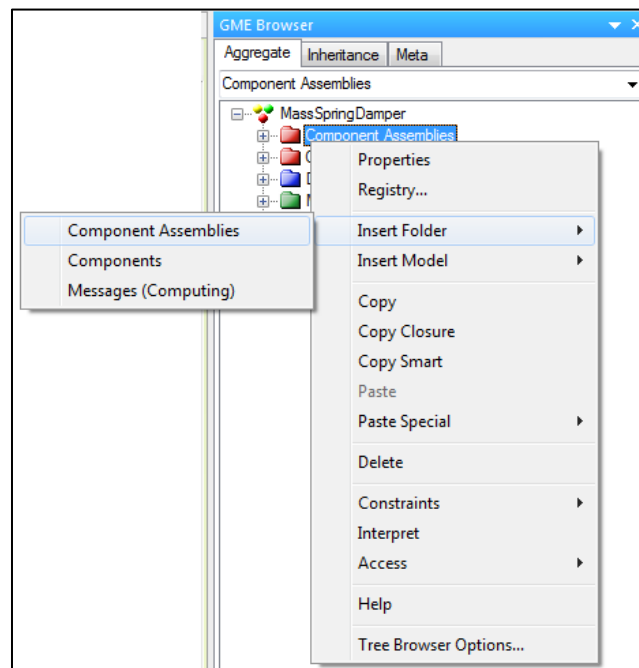

Step 3: Create Component Assembly

Now that you have a new assembly open, the next step is to insert components into this assembly. **Right click your new assembly and select Insert Model > Component Assembly. Name this assembly "MyMassSpringDamper".**
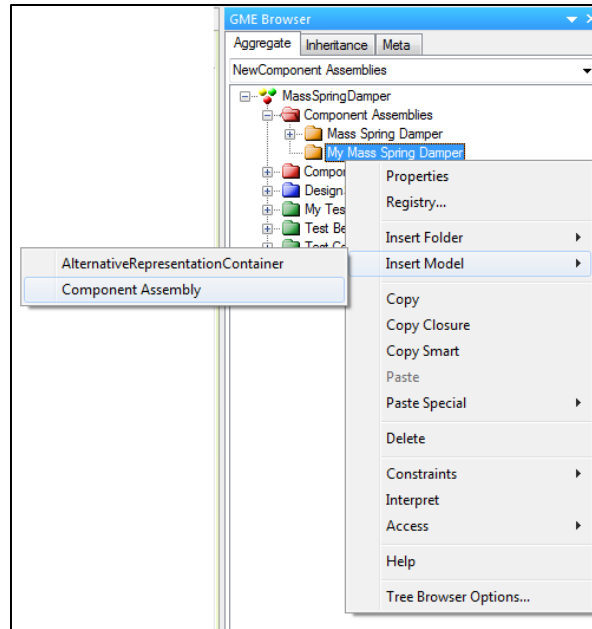
Copying Components Into Assembly

Step 4: Copy/Pasting Components into Assembly

Double click on the newly created component assembly model titled "MyMassSpringDamper". This will open a blank window in the Editing Area. In the GME Browser, **locate the first component you wish to add to the Editing Area. Expand the Components folder then the Dampers Folder. Right click on Damper_10 and select copy.**
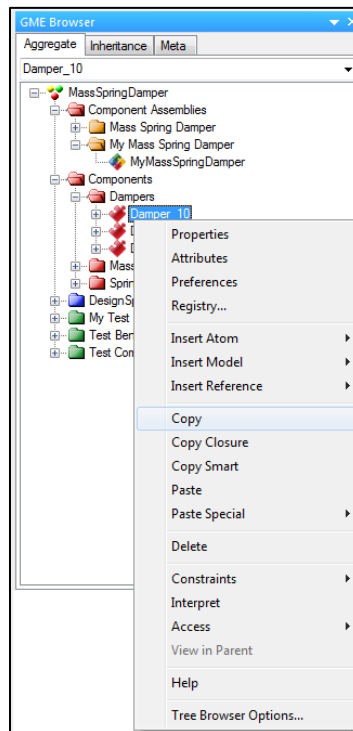
After copying Damper_10, **right click into the open Editing Area. Select Paste Special > As Reference**. Damper_10 will now be located in the Editing Area. **Add components named: Mass_Steel and Spring_Steel to the Editing Area by repeating Step**.
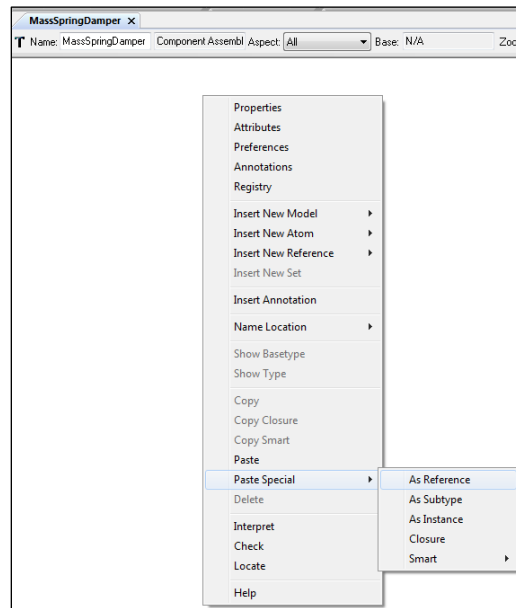
Make Connections Between Components in the Solid Modeling Aspect
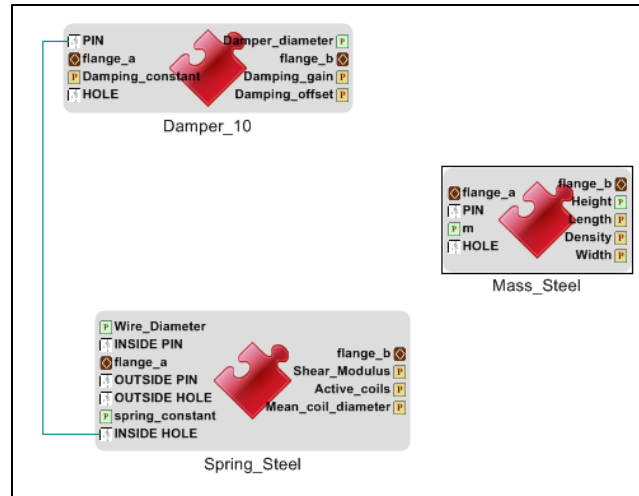
Step 5: Enable Connect Mode
Once the three components are located inside of the Editing Area, the next step is to enable the connect mode. This can be enable either by **pressing CTRL+2 or selecting the following button** located on the left side tool bar.
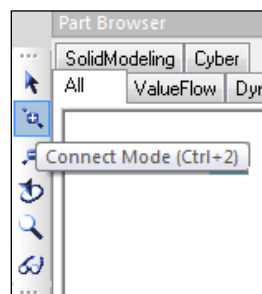

Step 6: Connecting Solid Modeling Ports
The Solid Modeling ports generate the physical connections between components used in CAD modeling. After *Connect Mode* has been enabled, the components need to be connected to each other. **First click on the square labeled *PIN* on the damper component. Then connect it to the square labeled *INSIDE HOLE* on the spring component**. This will create a connection between these two components.
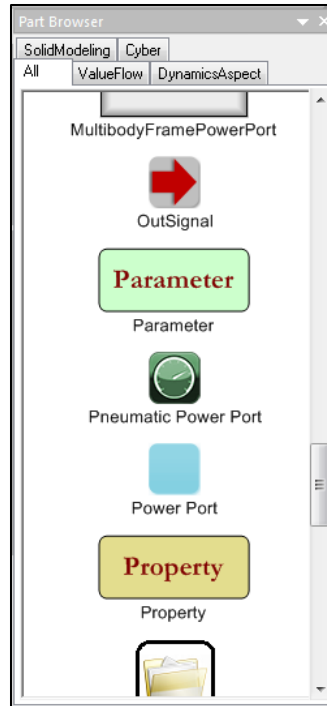
Repeat Step 6 with *Connect Mode* **still enabled.** The following ports between components should be connected as seen in the picture below. *OUTSIDE PIN* **on the spring component should be connected to** *HOLE* **on the mass component.**
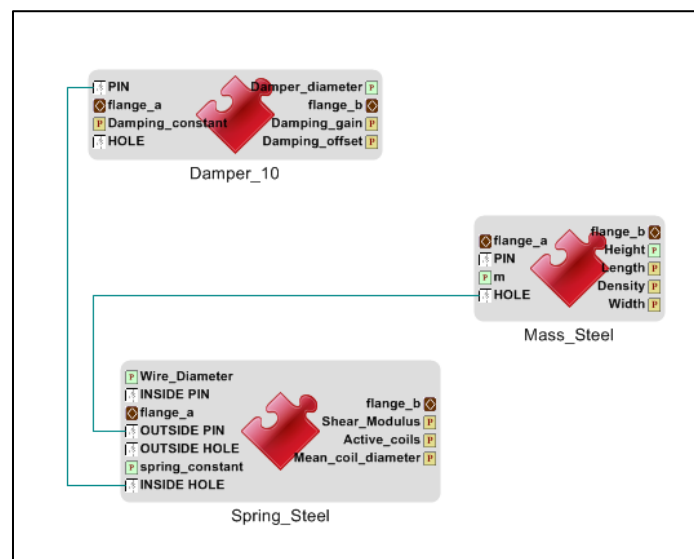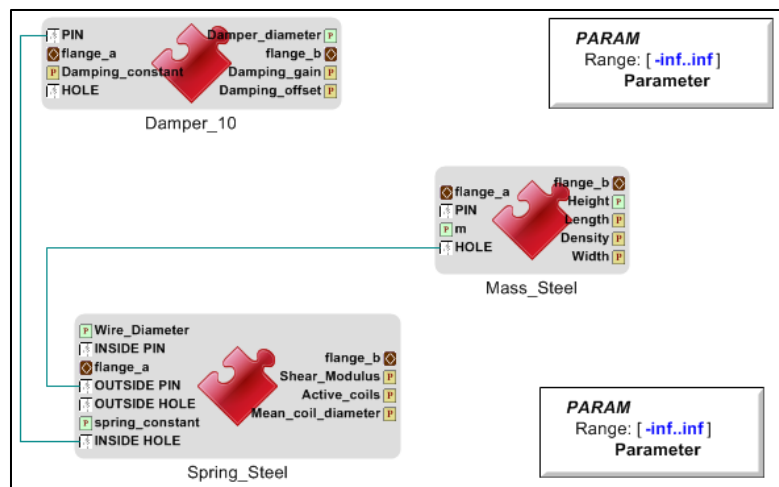

Add Parameters

Step 7: Adding Parameters to Work Space

**Locate the** *Parameter* **icon in the Part Browser to the left of the Editing Area.**

Drag and drop this icon into the Editing Area. Add an additional parameter icon so that the Editing Area appears as below.


Step 8: Defining Parameters

Now that there are two parameter icons in the Editing Area, the next step is to give these icons values. **Ensuring that *Edit Mode* is selected [CTRL+1], click on one of the parameter icons in the Editing Area.** Using the Object Inspector Browser to the right of the Editing Area**, fill out the parameter values as shown below.**
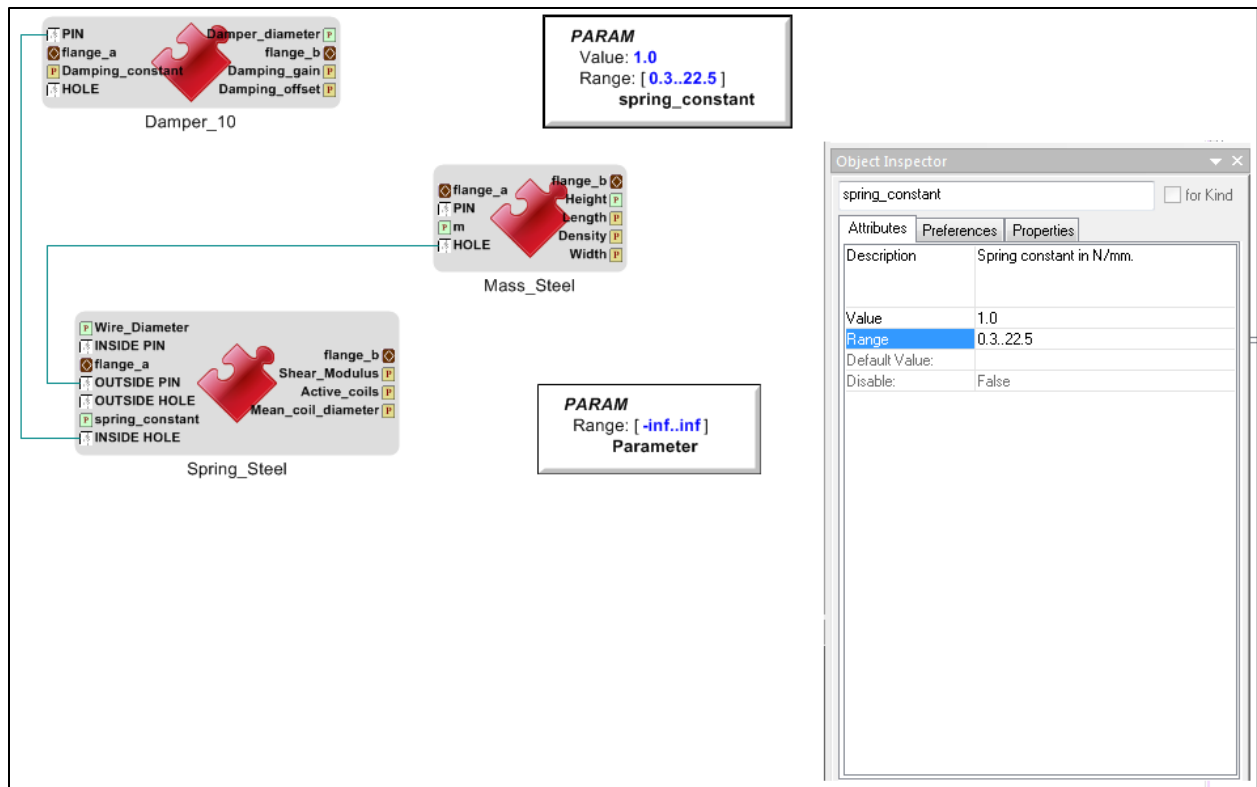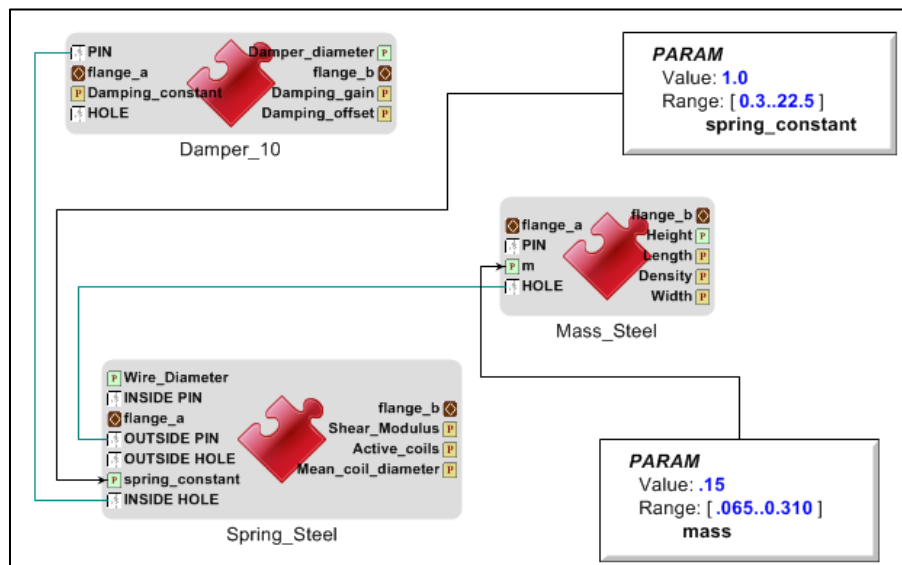
Repeat Step 8 for the second parameter icon in the Editing Area with the values shown below.
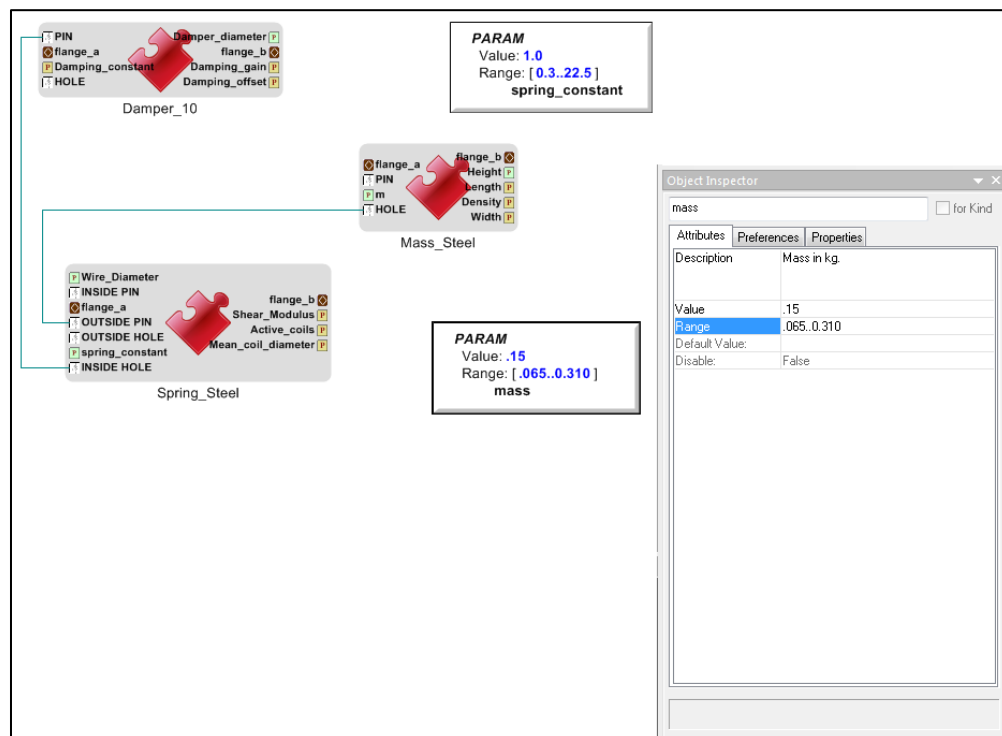
### Step 9: Connecting Parameters to Components

Enable *Connect Mode*. Then connect the *Spring Constant* Parameter to the Spring component and *Mass* Parameter to the Mass component. The Editing Area should appear as shown below.

Making Connections Between Components in the Dynamics aspect

Step 10: Connecting Dynamic Ports

Dynamic Port connections are used to generate connections between components in Modelica models. **With *Connect Mode* enabled, first click *flange b* port on the Damper component and connect it to the *flange a* port on the Mass component. Next click the *flange b* port on the Spring component and connect it to the same *flange a* port on the Mass component.** The model should appear as seen below.
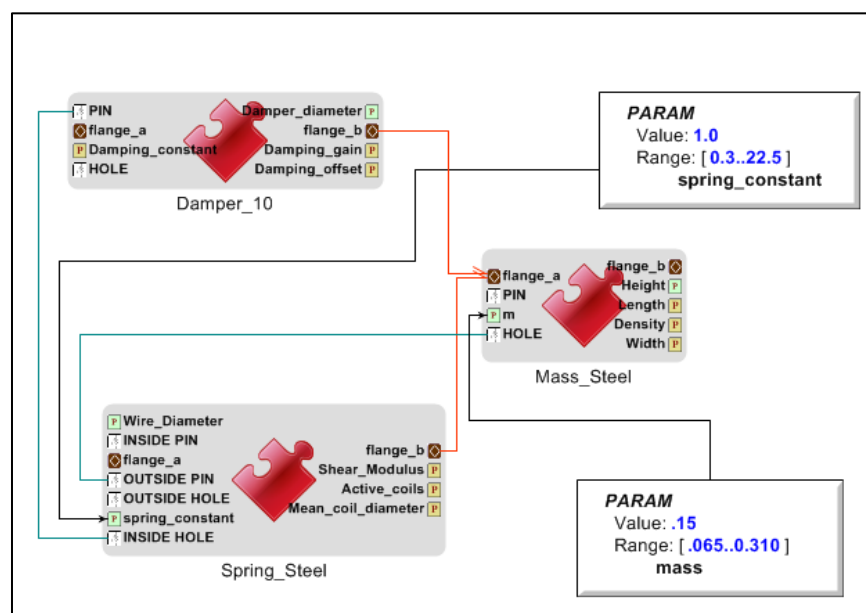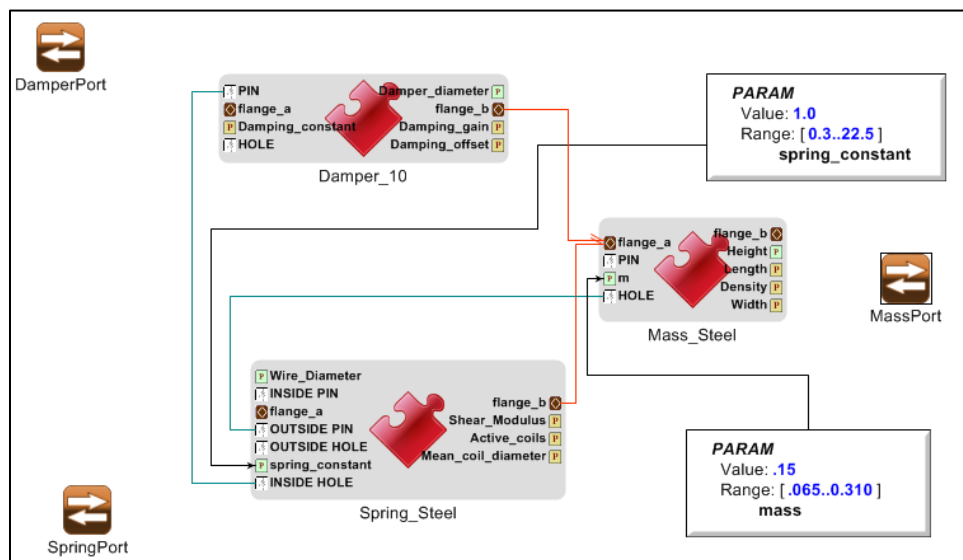
Ports

Step 11: Adding Ports

The addition of these ports enable the model to respond to outside signals. **Locate the *Translational Power Port* icon in the Part Browser. Drag and drop three of these icons into the Editing Area so that it appears as shown below.**
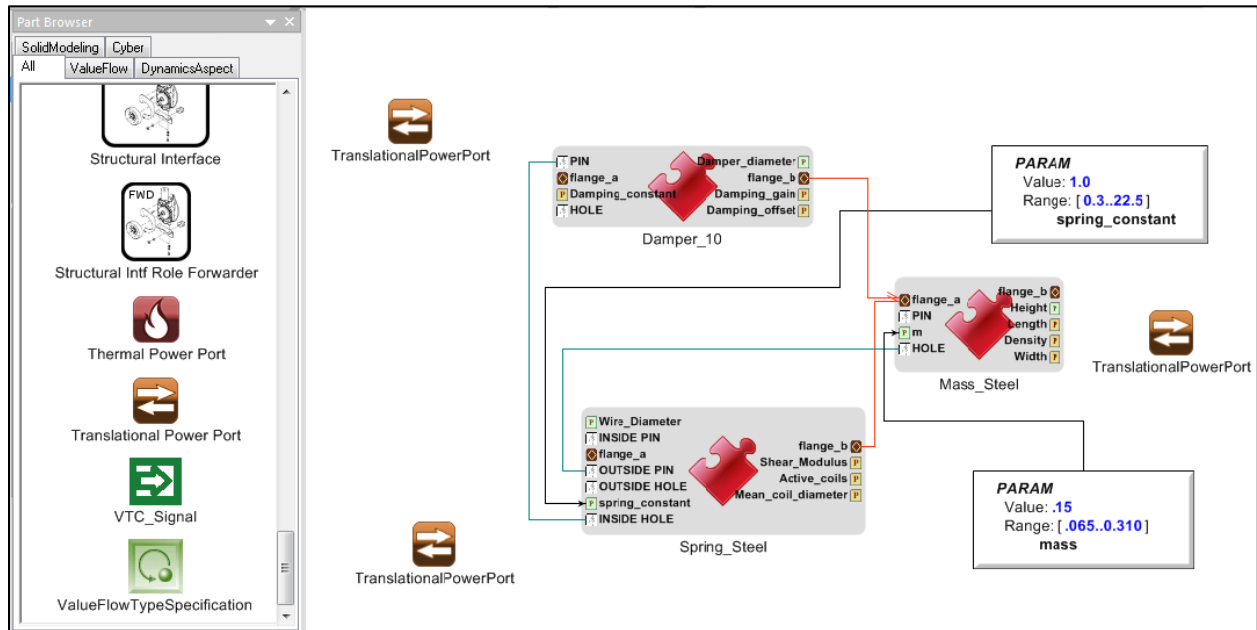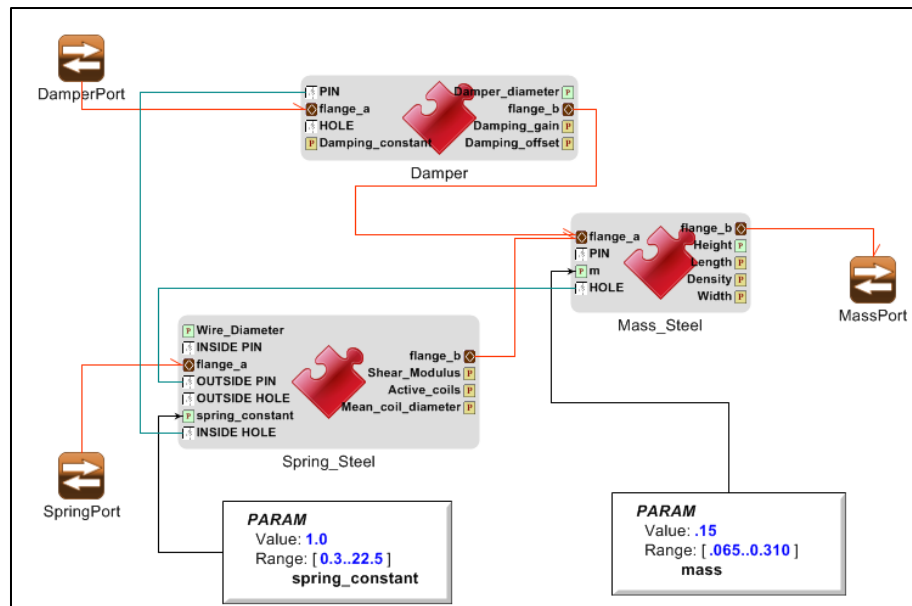

Step 12: Naming Ports

Using the Object Browser, **name the three *Translation Power Port* icons in the Editing Area as shown below.**

Step 13: Connecting Translational Ports to Components

Enable *Connect Mode*. Connect the newly added *Translational Power Port* icons to the components as shown below.

You've successfully created an assembly in GME. The next task is to create a test bench. For more information on this, visit the How to Create a Test Bench document.