SysML Hands-On Exercises

Exercise 5.1
SysML Parametrics Diagrams

MagicDraw

August 2018

OBJECTIVES

The objectives of this exercise are to

- Create a Parametric Diagram for the UAV to calculate mass.
- Use the ParaMagic tool to validate the parametric model.
- Create an Instance of the UAV assembly
- Use the ParaMagic tool to edit values and causality to the Instance.
- Solve the Instance for mass roll-up

This process is intended to represent building part of a complete mass roll-up calculation for the UAV.

PREPARATION

1. This exercise assumes the student has Cameo System Modeler 19.0 (or MagicDraw with SysML 19.0) and the ParaMagic plug-in for MagicDraw/CSM (ParaMagic 18.0 or later) installed correctly on his or her machine with valid licenses for use.
2. The student should load the Part 5 course materials onto the computer, specifically Exercise 5.1 Starter UAV.mdzip and Exercise 5.1 Final UAV.mdzip.
3. The student should view the video Introduction to SysML Part 5 Exercise 5.1 in its entirety before attempting the exercise.

NOTES AND CAUTIONS

We recommend that the student watch the video demonstration of this exercise in its entirety before beginning their own work. The video includes background and explanatory material that is not repeated in the written instructions.

We also recommend that the student read the material carefully. The most common source of error is confusion between blocks, packages and diagrams, some of which have similar names. When the student is not sure what an element is, either in the browser or in a diagram, select that element and look in the Properties tab for the gray label that identifies the element type. Also, be careful in reading the instructions in realizing when an instruction should be carried out in the browser or in a diagram.

EXERCISE

5.1.1 Start Cameo System Modeler

5.1.2 Open Exercise 5.1 Starter UAV.mdzip

5.1.3 Create a Parametrics Diagram

- Right-click on the **UAV** block inside the **UAV Design** package in the browser.
- Select Create Diagram → SysML Parametrics Diagram.
- In the Select Parts window, check the value and part properties as shown in Figure 1.
- Hit OK.
- Name the diagram **UAV Mass PAR**.
- Drag the **MassAdd_2Parts** constraint block in the UAV Library::Constraints package from the browser into the diagram.

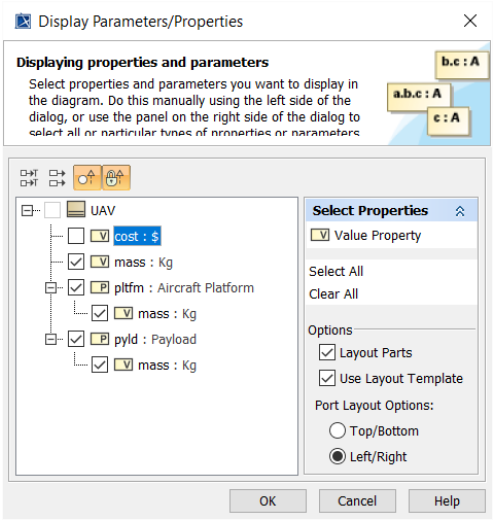

Figure 1 Select Parts for UAV Mass PAR

- Cancel the Parametric Equations Wizard. We will build the diagram manually.
- Name the resulting constraint property **ma2p1**. The parametrics diagram should appear similar to Figure 2.

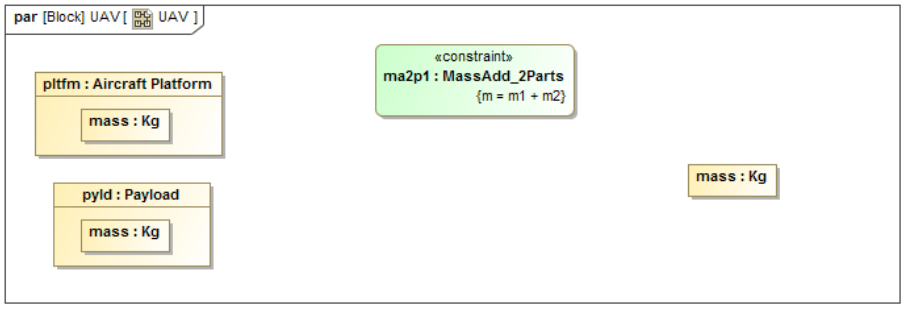

Figure 2 UAV Mass PAR diagram, first stage

- Select the **ma2p1** constraint property on the diagram.
- From the floating toolbar (Figure 3), click Display All Parameters.
- Rearrange constraint parameters as needed. If constraint parameter type is not showing, right-click on a constraint parameter and check Show Type.
- Select the **mass** value property inside the **pltfr:Aircraft Platform** part property and display the floating toolbar.

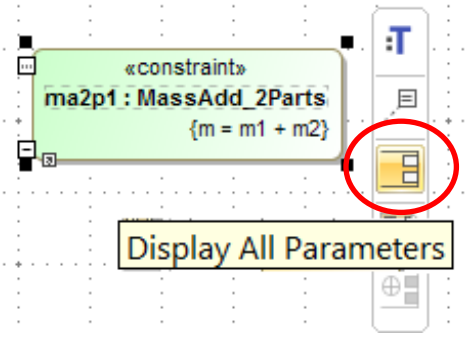

Figure 3 Display All Parameters for ma2p1 constraint property

- Select the binding connector and drag end to **m1** constraint parameter.
- Repeat for a binding connector from the **mass** value property inside the **pyld:Payload** part property to m2.
- Repeat for a binding connector from the **mass** value property of the **UAV** block to **m**.
- The parametrics diagram at this stage should appear as in Figure 4.
- Right-click the **UAV** block and select ParaMagic → Validate to check model.

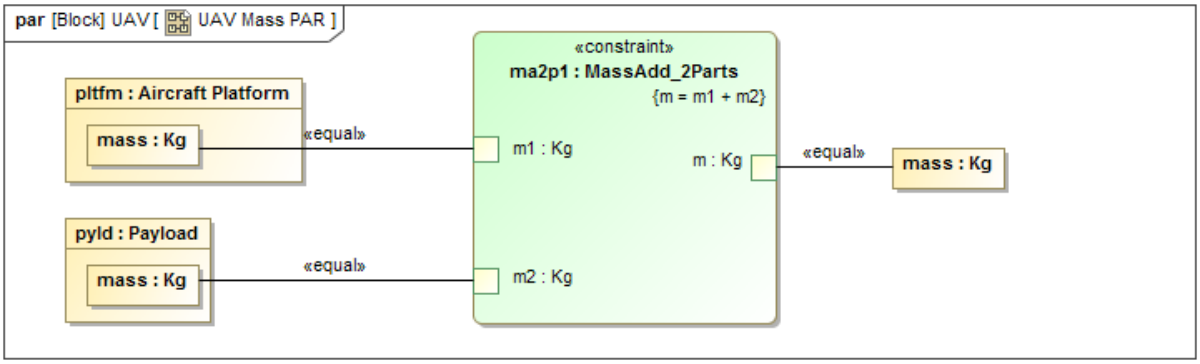

Figure 4 UAV Mass PAR diagram, complete

5.1.4 Create an Instance of the UAV structure

- Right-click the **UAV** block in the browser.
- Select Tools → Create Instance…
- In the first window (Figure 5), check the boxes as shown and click Next.
- In the second window (Figure 6), select the **UAV Analysis** package. Click Create and choose Package. Name the new package **Instance 3.1**. Close the new package Specification window and click Next.
- In the third window (Figure 7), check the boxes for a new diagram and to show links. Name the new diagram **Instance 3.1 BDD.** Select the **Instance 3.1** package to contain the new diagram. Click Finish.
- After rearranging the instances, the diagram **Instance 3.1 BDD** should appear similar to Figure 8.

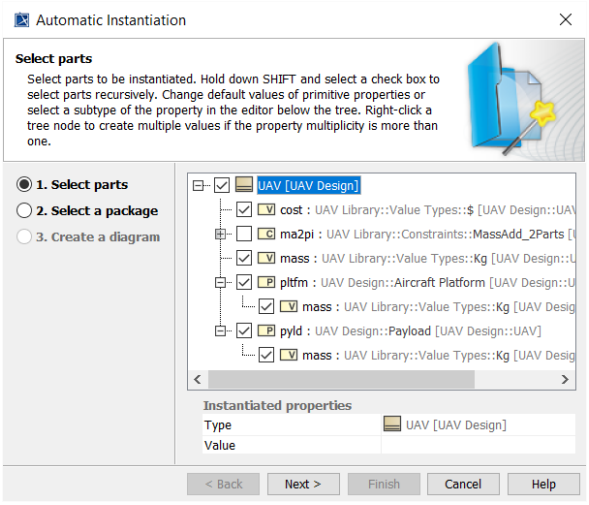

Figure 5 Create Instance, stage 1

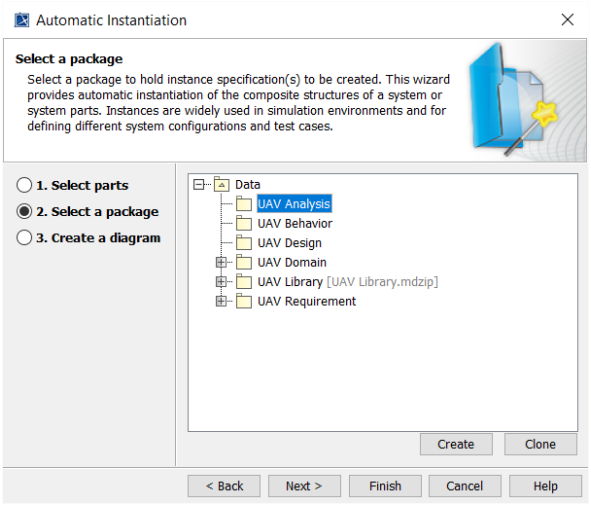

Figure 6 Create Instance, stage 2

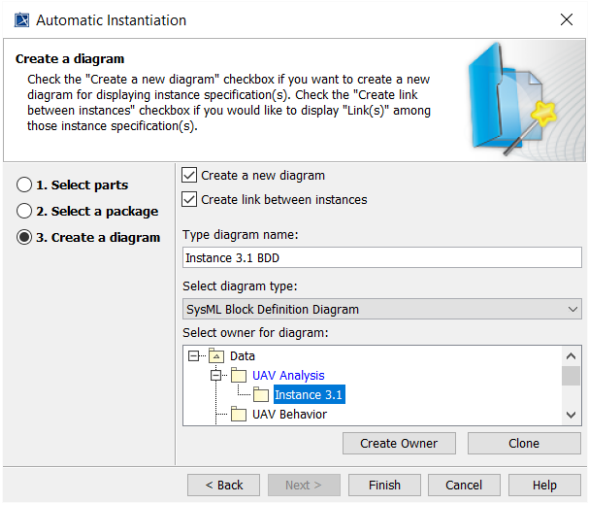

Figure 7 Create Instance, stage 3

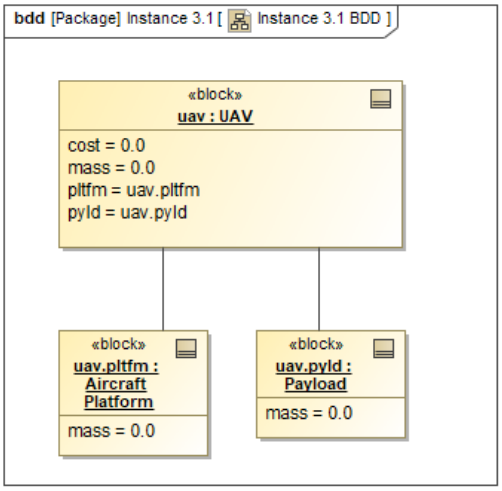

Figure 8 Instance 3.1 BDD

5.1.5 Assign Initial Values and Causalities in ParaMagic

- Right-click the **uav:UAV** instance in the **UAV Analysis::Instance 3.1** package in the browser and select ParaMagic → Browse to launch the ParaMagic browser.
- On the initial error message, click Reassign to assign causalities.
- Click the Expand button to show all parameters. The ParaMagic browser should appear as shown in Figure 9.
- In the browser, set the initial values and causalities as follows
  - UAV.mass causality = target
  - pltfrm.mass Causality = given Value = 250
  - pyld.mass Causality = given Value = 50
- The result (Figure 10) can be used to update the SysML instance, if desired.
- Click Solve. The final result is shown in Figure 11. Close and save the project.

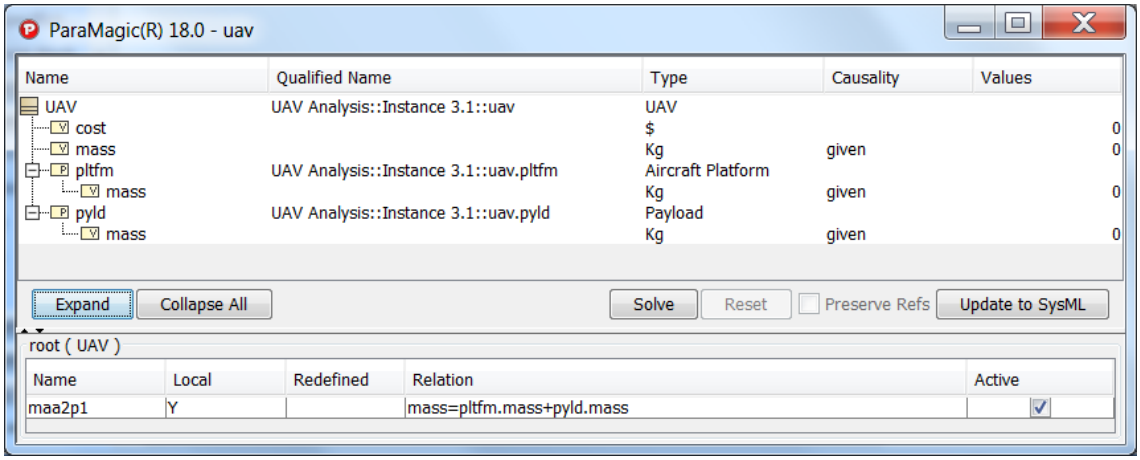

Figure 9 ParaMagic browser, stage 1

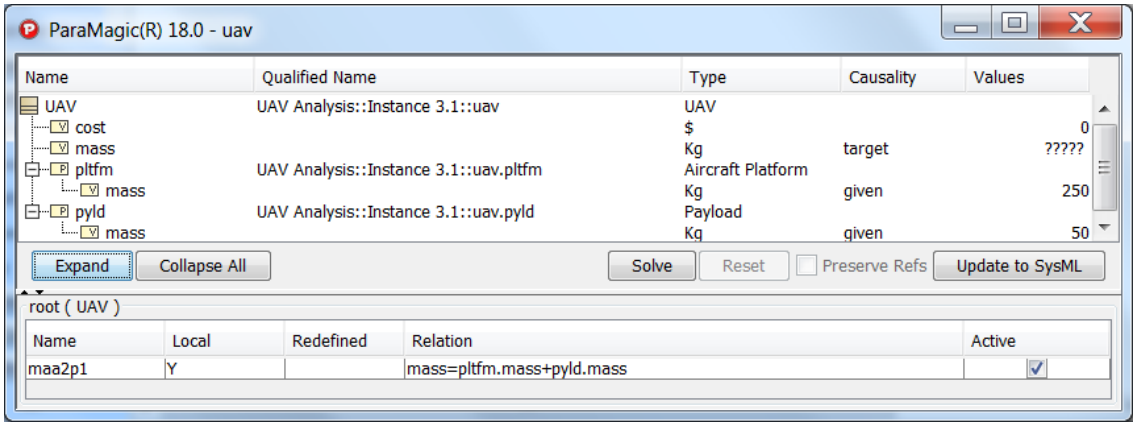

Figure 10 ParaMagic browser, stage 2

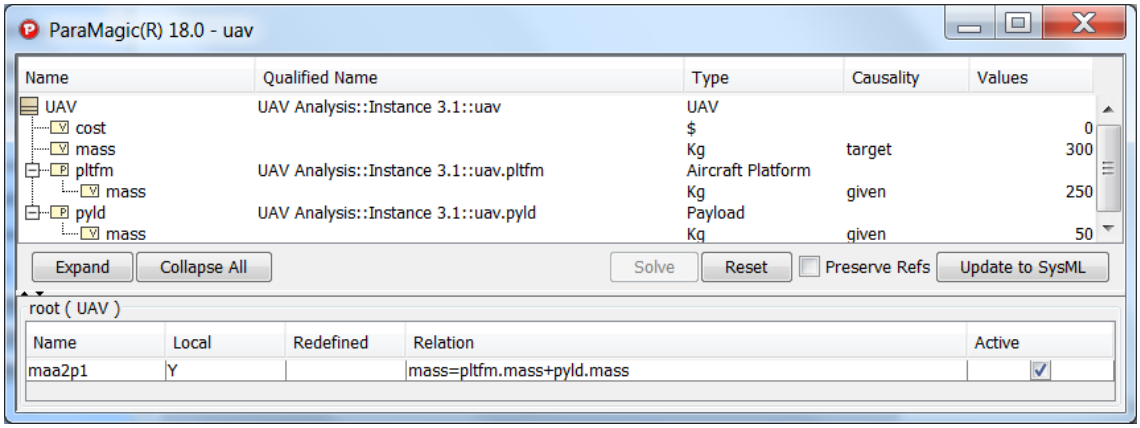

Figure 11 ParaMagic browser, stage 3