Chapter 2: **Hello World**

The most basic Modelica model is a differential equation. In this example a differential equation is implemented and simulated. Also, the process of creating an icon representing the model graphically is described in detail.

2.1 Hello World model

There is a long tradition that the first example in any computer language is a trivial program printing the string "Hello World". Since Modelica, the language used in *MathModelica*, is an equation-based language, printing a string does not make much sense. Instead our Hello World Modelica program solves a trivial differential equation:

$$\dot{x} = -x$$

The variable x in this equation is a dynamic variable (and a state variable) whose value can change over time. The time derivative is the derivative of x, written as der(x) in Modelica. All Modelica programs consist of a class declaration (block, model, package, etc.). In this example we will declare the program as a model.

We begin by creating a new model at the top level of the Modelica package hierarchy, i.e., the model will not be located inside a package. Choose New Class from the File menu.

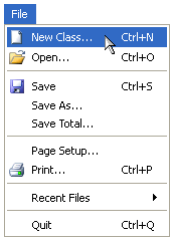


Figure 2-1: Choosing New Class from the File menu.

This will open the New Class dialog box in which we will specify a name and description

for the model. Give the model the name "HelloWorld" and the description "A differential equation".

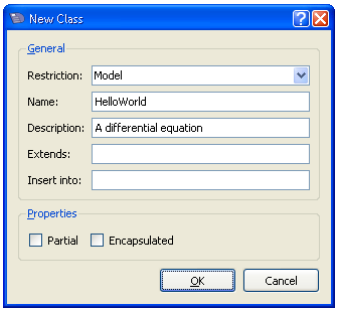


Figure 2-2: Specifying a name and description for a new model.

When clicking the OK button, the model will be created and become visible in the library browser. At the same time the model will also be opened in a class window. Click the Modelica text view button in the toolbar to switch to the Modelica text view of the class window.

Figure 2-3: The Modelica text view button in the toolbar of the model editor.

The textual representation of the model should look as follows:

```
model HelloWorld "A differential equation"
  annotation(...);
end HelloWorld;
```

The annotation in the second row contains graphical information about the model and is automatically updated whenever you edit the model in any of the graphical views of the class window. Note that the description that we entered in the dialog box has been added to the model. Now it is just a matter of adding the variable and the equation. We will do that by editing the definition of the model directly in the Modelica text view.

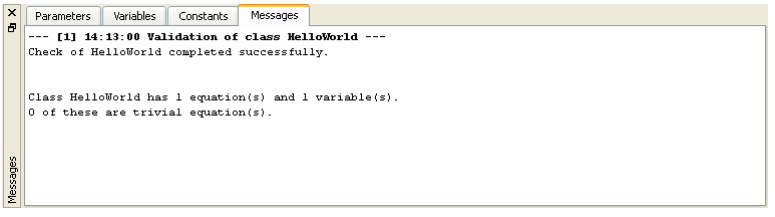
```
model HelloWorld "A differential equation"
  annotation(...);
  Real x(start=1);
equation
  der(x)=-x;
end HelloWorld;
```

Note that when we declare the variable we also set its initial value to 1 by specifying a value for its parameter start.

The HelloWorld model is now ready. Before simulating the model, we may want to verify its correctness by clicking the validate class button in the toolbar.

Figure 2-4: The validate class button in the toolbar of the model editor.

This will generate a report in the Messages View, located below the class window.



If everything was typed in correctly you should find a report similar to the one above.

To perform the simulation of the model we need to start Simulation Center, the simulation environment of *MathModelica*. Click the Simulation Center button in the toolbar.

Figure 2-5: The Simulation Center button in the toolbar of the model editor.

Simulation Center will start and the HelloWorld model will automatically be translated into an executable. An experiment is created for the Hello World model in the experiment browser of Simulation Center.

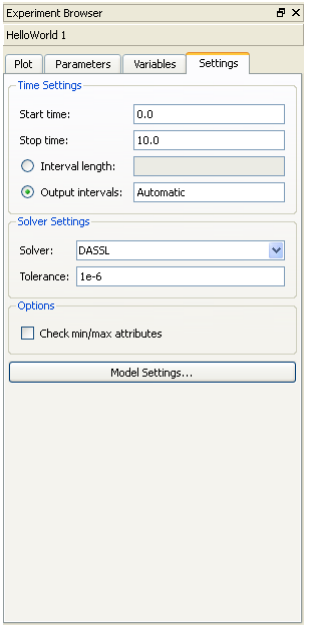


Figure 2-6: The settings view of the HelloWorld experiment in Simulation Center.

In the experiment browser you are able to specify simulation settings, parameter values, and initial values for variables, but we will leave it as is for now. Instead we will click the simulate button to start the simulation.

Figure 2-7: The simulate button in the toolbar of Simulation Center.

After the simulation is completed, the plot view of the experiment browser becomes visible. Click the check box in front of the variable x to plot the result.

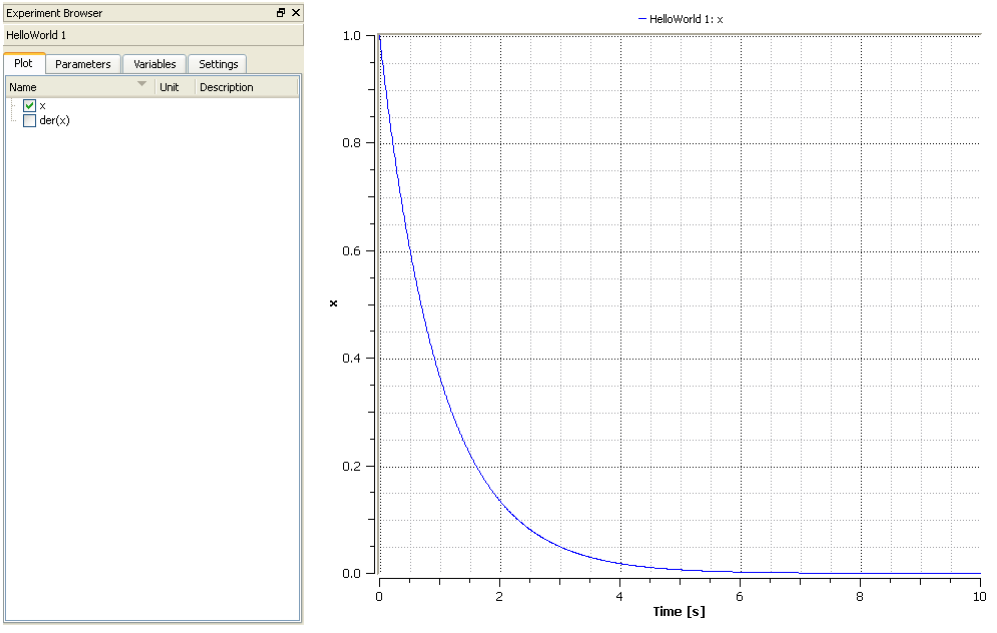


Figure 2-8: Plotting the variable x of the HelloWorld model in Simulation Center.

We will now return to the model editor in order to create an icon for the model. Switch to the icon view of the class window by clicking the icon view button in the toolbar.

Figure 2-9: The icon view button in the toolbar of the model editor.

To create an icon we will use the drawing tools available in the toolbar of the model editor.

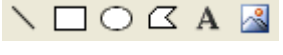


Figure 2-10: The drawing tools in the toolbar of the model editor.

By choosing the rectangle tool it is possible to draw rectangles. Draw a rectangle covering the white area of the icon view. Double-click the rectangle to view and edit the properties of the rectangle.

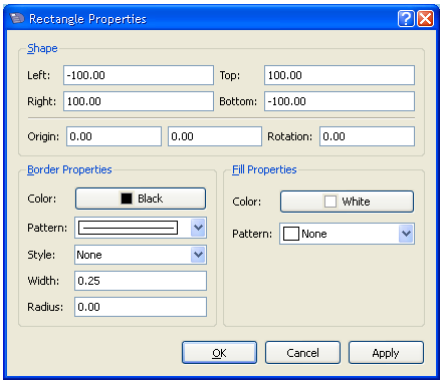


Figure 2-11: Editing the properties of a rectangle.

Change the fill color to grey and select Solid as the fill pattern and click the OK button. Next, press the **Esc** key to clear the selection in the icon view. Finally, choose the text item tool and draw a text item covering the entire rectangle, and change the text to "Hello World" in the properties dialog box. The reason why it was necessary to clear the selection before drawing the text item deserves an explanation. Without clearing the selection, we would have ended up moving the rectangle instead of adding a text item, as all drawing tools can also be used to move selected items.

The icon of the model should now look similar to the one below.

Figure 2-12: The icon of the HelloWorld model.

The HelloWorld model will from now on be represented by this icon everywhere it is used.

2.1.1 Exercise

Change the model equation, for instance by adding a parameter and test the result.