

## Solution to the Exercise

The hypothesis to be tested as an extreme condition test for the test model is given as follows;

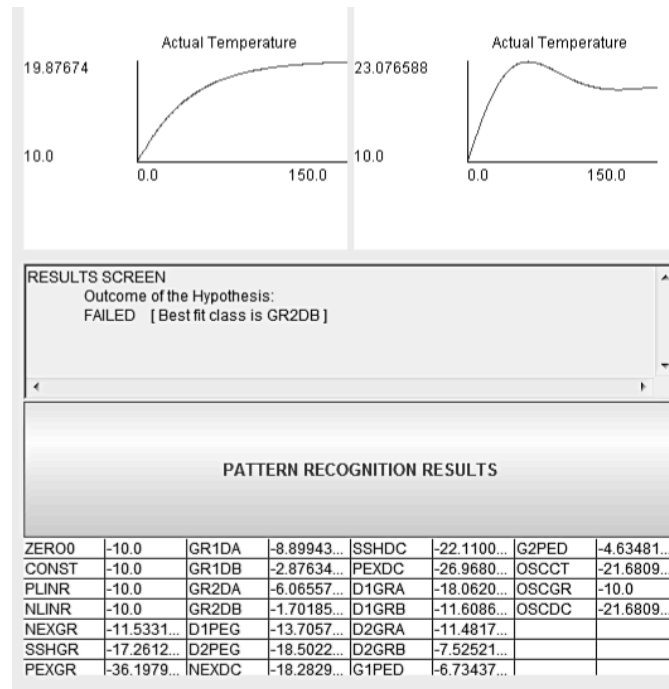
*Hypothesis:* When *Desired Temperature* is higher than the initial value of the *Actual Temperature* variable, and the *Measurement Delay* is equal to *Adjustment Time*, the model is expected to demonstrate a negative exponential growth (converging to the *Desired Temperature*) behavior.

We specify this test in the SiS environment following the steps described in the Section 4.2 of the chapter (see Figure 1). When we run this second test, SiS reports a FAIL as expected. The resulting output from the test is given in Figure 2. As can be seen on the top right section of the screen, the Actual Temperature variable overshoots the desired temperature and then converges to it from above under the specified conditions. SiS classifies this behavior as an example of growth and decline type of behaviors (i.e. GR2DB) as can be seen in the dialog box. As this class does not match the hypothesized behavior class (i.e. NEXGR), the program evaluates the test as a failed one.

The screenshot displays the 'Validity Testing by Setting Parameters' dialog box in the SiS interface. The interface is organized into several sections:

- Top Section:** Contains a dropdown menu labeled 'Validity Testing by Setting Parameters'. Below it are buttons for 'Open Vensim Model', 'Load Model', 'Get Variable List', and 'Graph Results'. To the right, there is a text field containing 'TestModel.vmf' and a 'Simulate' button.
- Variable Selection:** A dropdown menu shows 'Actual Temperature'.
- Parameter Selection:** A 'Get Parameter List' button is followed by a dropdown menu showing 'Measurement Delay'.
- Parameter Value Setting:** A 'Selected Parameter:' label is followed by a text field containing 'Measurement Delay'. Below it, a 'Set Value' label is followed by a text field containing '20'.
- Confirmation:** A 'Confirm Value' button is located below the 'Set Value' field.
- Hypothesis Selection:** A 'Select Hypothesized Graph:' label is followed by a dropdown menu showing 'NEXGR'.
- Graph Description:** A text area on the left contains 'Graph Description: Negative Exponential Growth'. To its right is a small icon representing a graph.

Figure 1. Setup of the experiment on SiS interface



**Figure 2. Results of the hypothesis test on SiS interface**

This is a deliberately selected test that is known to fail in order to demonstrate the response of SiS in such cases. The temperature adjustment system depicted in the test model is known to overshoot the desired temperature when the ratio of the measurement delay to the adjustment time is increased. The given model starts overshooting the desired temperature when the ratio of Adjustment Time to Measurement Delay is less than 4. The overshoot behavior becomes clearly visible as this ratio decreases further. As a result, both the observed model behavior and the test result generated by SiS are consistent with theoretical expectations.