Model Analysis Using the Event Log in Dymola

Typical Modelica models use a combination of continuous and discrete equations to achieve maximum expressive power, accuracy and efficiency.

However, the handling of discrete events does incur a certain overhead which may need monitoring. Especially for real-time applications events should be avoided to guarantee execution time. An excessive number of events may indicate a modeling error.

Dymola 2018 FD01 has been enhanced with convenient tools to check what events are generated during simulation and plot hot-spots of execution.

Event basics

Discrete events can be generated by several constructs in a Modelica model, for example:

► Relational expressions such as `speed > limit`, unless encapsulated in `noEvent()`.

► The use of discrete variables and when-clauses.

► Time events caused by the sample-operator or expressions involving the simulation time.

Accurate detection of events is essential for correct and efficient simulation in many applications. Many numerical integration methods also support the notion of zero-crossing functions.

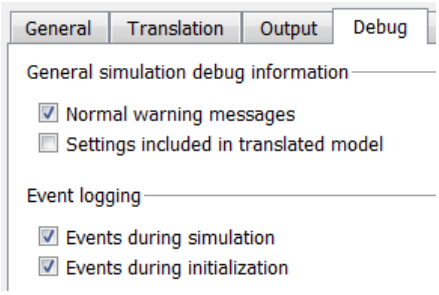
One event may lead to other events being triggered. In such a case the event handling is iterated until no further events are triggered.

For critical real-time HIL applications as few events as possible are preferred because the extra work may push execution time in excess of the permitted slot. The event log may help finding remaining events.

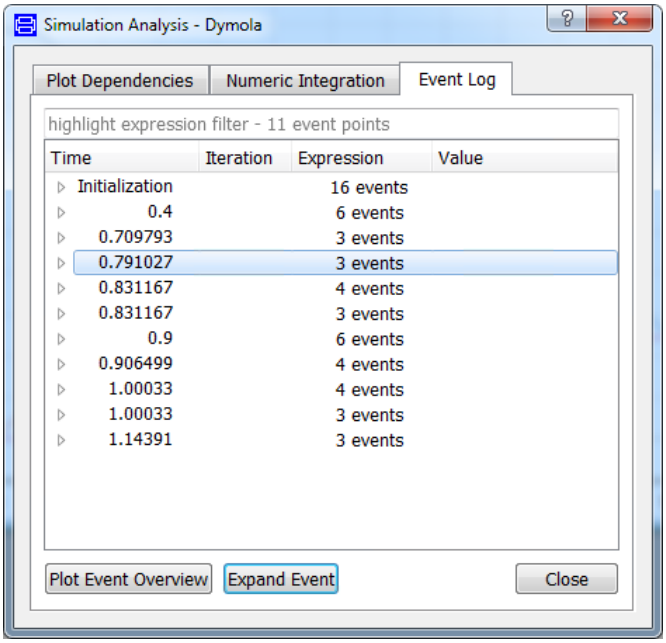
Event logging in Dymola 2018 FD01

Event logging has existed in Dymola for years, but the output in the simulation log file has been less than ideal and quite voluminous. The new event logging feature provides a convenient user interface to inspect the data and analyze the simulation behavior.

Go to the Debug tab of Simulation>Setup before starting the simulation and enable event logging.



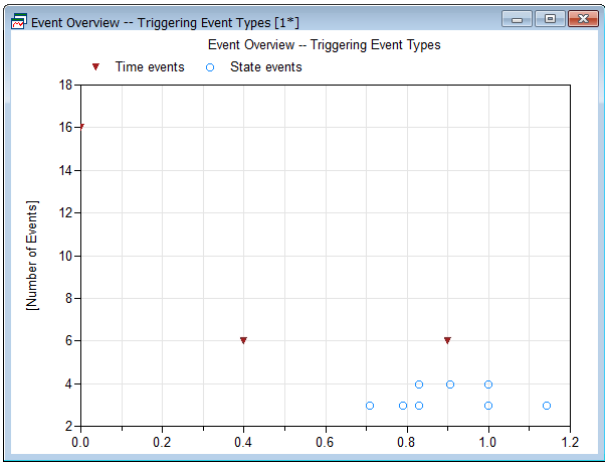
After running the simulation right-click on the simulation in the Variable Browser and choose Analyze Numerics from the menu. A new tab, called Event Log, is available in the window that opens.



In this window we are given a list of all the event points that happened during the simulation, sorted by time. If the option “Events during initialization” was set before simulation those events will also be presented as the first entry. For each event point the number of events is shown. The exact time is available as a tooltip.

The event overview

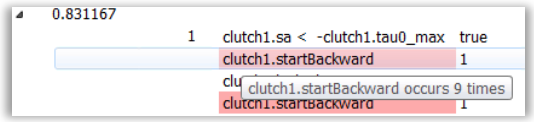
By clicking the Plot Event Overview button a window is shown where the event iterations at each event point are plotted. The vertical axis displays the number of events in the iteration and the type of marker gives the type of event (time or state) that triggered the iteration.



Inspecting individual events

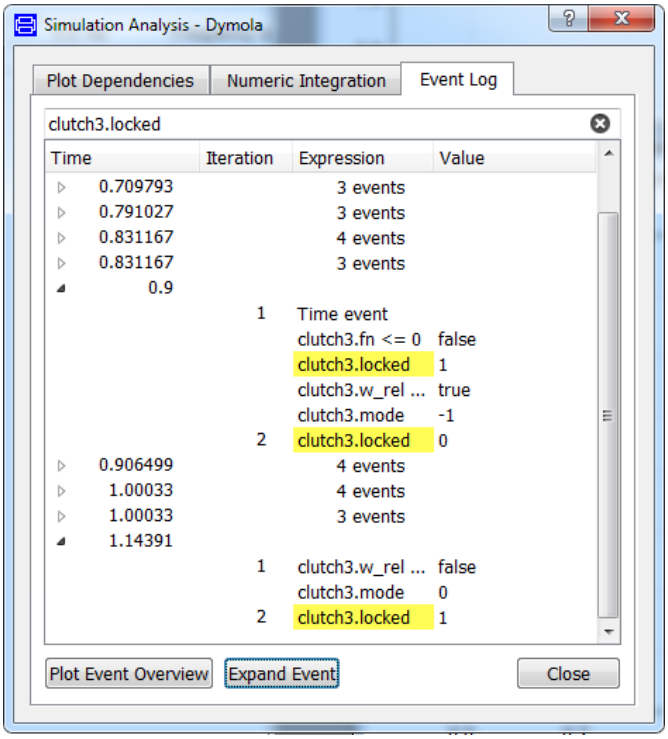
Expanding one of the rows in the Event Log table gives more details on which events were involved in each event iteration. It shows the expression that triggered the event and the value of the expression after the event.

To help analysis, the most frequently occurring events are marked in red and the tooltip shows the count.

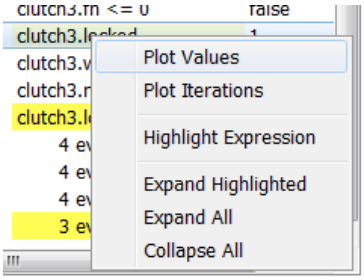


Double-clicking a row highlights all occurrences of this event expression in yellow, including collapsed event point rows. Highlighting can also be made by typing in an event expression in the search filter line above the table. Highlighting is removed by clicking on the clear button at the end of the search filter.

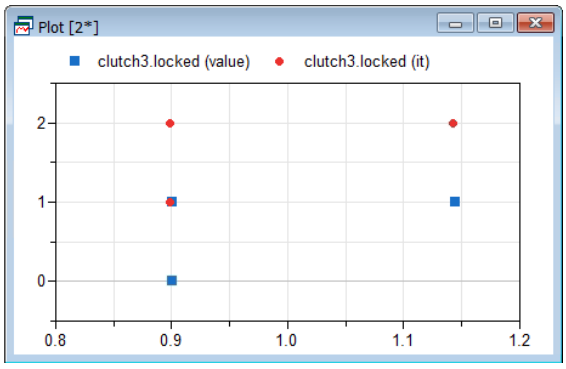
Clicking on the Expand Event button highlights all occurrences of the selected event expression, and expands the event points that contain a highlight.



Further operations are available through right-clicking to display the context menu.



The values of the event expression, and the iteration number each time the event expression changed can be plotted in the currently active plot window.



Conclusions

The new event log provides easy inspection of discrete events occurring during simulation, facilitating the development of efficient and correct models.