Course 7

Waveform Viewer

Table of Contents

Introduction

Active-HDL stores simulation results in a signal database file for easier design management

- Aldec simulation and hierarchy design database are stored in the *wave.asdb* file; the simulation database contains waveforms of signals recorded by the user and information about the design hierarchy

Recording signals

Adding signals using Structure tab and Object Viewer

- Once the simulation is initialized, you can open the new waveform file using New Waveform  from main menu.
- You can add all signals from any level using the Structure tab or any individual signals using the **Object Viewer**. For this you can simply drag and drop the signals to the Waveform Viewer or you can right click on the item in the **Structure tab** and use **Add to Waveform** option from the context menu.

Using the log command (GUI Only)

The log command dumps the history of the specified signals to a simulation database file (*.asdb*).The default name of the simulation database file is *wave.asdb*. By default this file is created in the current directory.

Example:

// dumps all ports recursively declared in the UUT design region
```
> log –rec -ports UUT/*
```

// dumps the CLK and RST signals from the current design region
```
> log CLK RST
```

Using saved macro file

If you saved your signal list to a macro file (.do / .tcl extension) then adding signals in successive simulations is as simple as executing this macro file.

1) In the console enter: `do my_signal_list.do`, or
2) You may right click on the macro file in the **Files** tab of **Design Browser** and select **Execute** option from the drop down menu.

Please refer to the Saving Waveform Configuration section below to learn how to save a signal list to a macro file.

Saving waveform configuration

Saving to .awc file

You may save the current configuration of the Waveform Viewer (i.e., list of signals, signal properties, etc.) to .awc file for the future browsing and reuse. To save a waveform configuration set focus on the Waveform Viewer by clicking on it and select **File | Save** or **Save As**… menu.

Waveform configuration file (.awc) can be used for two purposes:

1. Loading the saved configuration of a simulation dataset to the Waveform Viewer.
2. When .awc file is opened after the simulation is initialized (after asim command), it makes the simulator to start logging all the signals listed in the .awc file.

Saving signal list to a macro file

Alternate way to save the current Waveform Configuration to .awc file is, saving it to a macro file. This gives you more flexibility, unlike .awc file, the macro file does not require the dataset files (*.asdb) to be present.

After you have added all the signals of interest to the Waveform Viewer you can save the list of signals with display parameters to a macro file by selecting **'Save To Macro'** menu option from the **Waveform** menu. Note that the Waveform menu is only active when the focus is set inside the opened Waveform Viewer.

Note: By default Active-HDL removes all the signals during reinitialize of simulation. This behavior can be changed by changing the settings in waveform preferences. Go to **Tools | Preferences | Waveform Viewer/Editor | Accelerated Waveform Viewer** and click on **Options**. Now go to **Behavior – advanced** tab and check mark option **Preserver signals when simulation is initialized** under category **Signals Tracing**.

Opening the recorded signals

Loading signals from the recorded dataset

To display the signals in the Waveform Viewer you need to start Active-HDL in the GUI mode. Double click on *.asdb file displayed in Files tab of Design Browser. This will load all log signals as well as the waveform inside waveform window.

This will make the Structure tab and the Object Viewer to show the signals and values from the opened dataset.

After the dataset has been opened, you can view the hierarchy of the design in the Structure tab and signal information in the Object Viewer.

To add any region of a design with all signals to the Waveform Viewer right click on the required design block in the Structure tab and select Add to Waveform option from the pop-up menu.

To add individual signals to the Waveform Viewer highlight the design region of the interest in the Structure tab first and then drag the signals from that design region in the Object Viewer and drop them to the Waveform Viewer or use Add to Waveform pop-up menu.

Loading recoded signals using .awc file

If you have .awc file saved as explained above you may simply double click on it in the Files tab of the Design Browser. It will open the Waveform Viewer and load all the signals with the waveforms to it.

Browsing the waveforms

Zooming methods

Zooming in and out

You may zoom in and out by clicking on the icons  or  respectively on the Toolbar of the Waveform Viewer. By default the view is zoomed around the active cursor. You can change this as described below under Default Zoom Focus section.

You can also zoom in and out by using a keyboard and a mouse. Scrolling your mouse wheel up while holding the CTRL key will zoom in the current view; scrolling the mouse wheel down while holding CTRL key will zoom out the view.

Zoom mode

In the Zoom Mode, you can select the area that should be zoomed in. The zoom mode is activated by clicking the **Zoom Mode**  button on the toolbar. The cursor changes its shape and in the zoom mode, it is shown as a magnifying glass. To select the zoom range, locate the cursor over the waveform, press

the left-mouse button and select the area to enlarge. The selected area will be denoted by the two vertical lines. When you release the left-mouse button, the Waveform Viewer will automatically zooms into the selected area.

Default zoom focus

By default the Waveform Viewer in Active-HDL zooms around the active cursor. Alternatively you may configure the Waveform Viewer to zoom around the center of the current view. To do so use **Options…** button menu item **Tools | Preferences | Waveform Viewer / Editor | Accelerated Waveform Viewer** and set **Zoom target** option to “Center of the waveform view” in **Behavior – basic** tab.

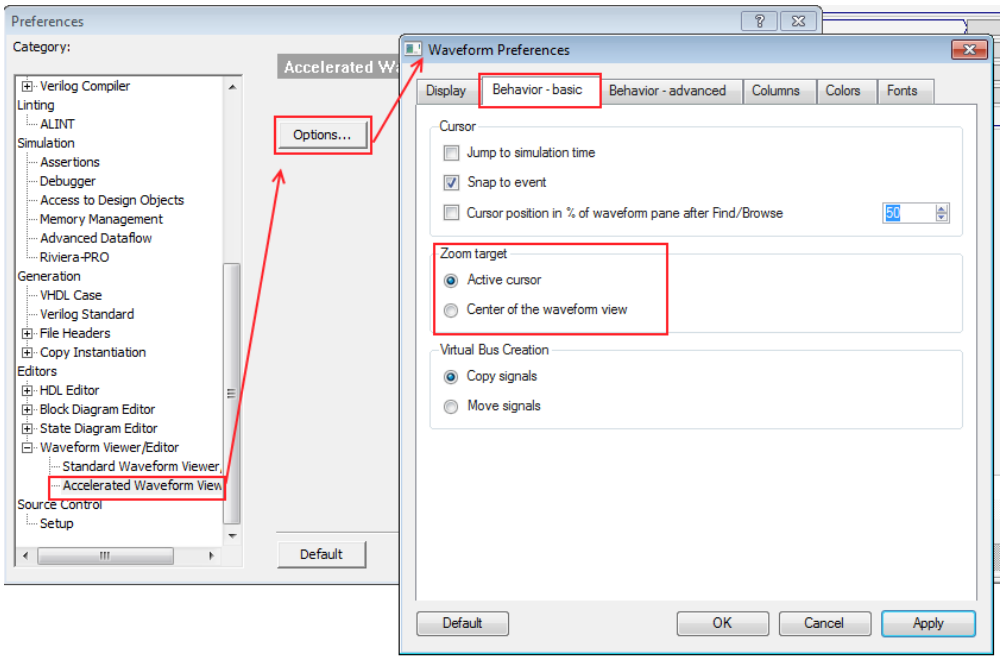

Figure 1 Accelerated waveform settings

Browsing modes

The Waveform View pane of the Waveform Viewer window can be browsed by using different methods. Browsing tools can be selected from a pop-up menu activated after you click on a button located in the right lower corner under the horizontal scroll bar. A pop-up menu with the browsing tools is activated after you click on the button. Each mode operates on the selected signals or on all signals if none of them is selected.

To select a browsing method click on the **Select Browse Object** button in the **lower right corner** of the Waveform Viewer and select the browsing method that you want to use.

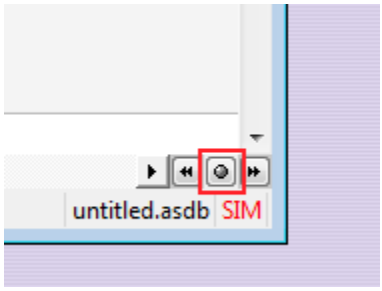

Figure 2 Browsing mode button

Clicking on the **Select Browse Object** button opens the pop-up menu with the set of available browsing tools.

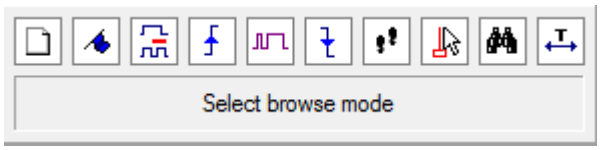

Figure 3 Browse mode

After you select the browsing tool, use the **Find Previous** and **Find Next** buttons to find the next matching event on the waveform. You can also use the **Ctrl+Left arrow** or **Ctrl+Right arrow** keys. The following browsing tools can be selected from the pop-up menu:

Browse by cursors - this tool allows setting focus on subsequent cursors and browsing by their locations.

Browse by bookmarks - this tool enables browsing the waveform by bookmarks. The bookmarks are special marks that can be placed at any point (time) in the waveform to accelerate switching between selected parts marked as important for design analysis, a reference, etc.

Browse by rising edges - the timing cursor jumps only between the rising edges of the signal(s).

Browse by falling edges - the timing cursor jumps only between the falling edges of the signal(s).

Browse by events - this tool moves the timing cursor from one event to another. An event is any change of a signal value, e.g. the rising or falling edge, X-to-1 change, etc.

Browse by differences - difference marks are the graphical objects created by the comparison tool (see Comparing Waveforms for more information). This method moves the timing cursor between subsequent difference marks (assuming that you have performed the comparison operation earlier and the operation ended up with some differences).

Browse by pages - browsing by page facilitates viewing waveforms by scrolling them page by page. The page length is equal to the time range that is currently displayed in the Waveform View pane. Also you can use **SHIFT+CTRL+**mouse wheel combination to scroll the waveform right (scroll up) or left (scroll down) by pages.

Browse by Measurement - This option allows browsing the waveform by measurements. A measurement is a graphical object that allows determining the distance between events on the same or different signals.

Bookmarks

Bookmarks in Active-HDL can be used to store:

- The position (time) of the cursor
- The vertical position in the waveform.

You can browse a waveform by bookmarks using the **Previous Bookmark** (Shift+F2) or **Next Bookmark** (F2) buttons.

To add a bookmark, you can set it at the current cursor position by using the **Toggle Bookmark** (Ctrl+F2) button on the Toolbar.

In order to remove a bookmark, place the cursor at the bookmark position (time) and select **Toggle Bookmark**. You can also remove all bookmarks by clicking on the **Clear All Bookmarks** (Ctrl+Shift+F2) button.

Show Event Source

Active-HDL allows you to jump from an event on a signal shown in the Waveform Viewer to the statement that caused that event by right clicking on that event in waveform.

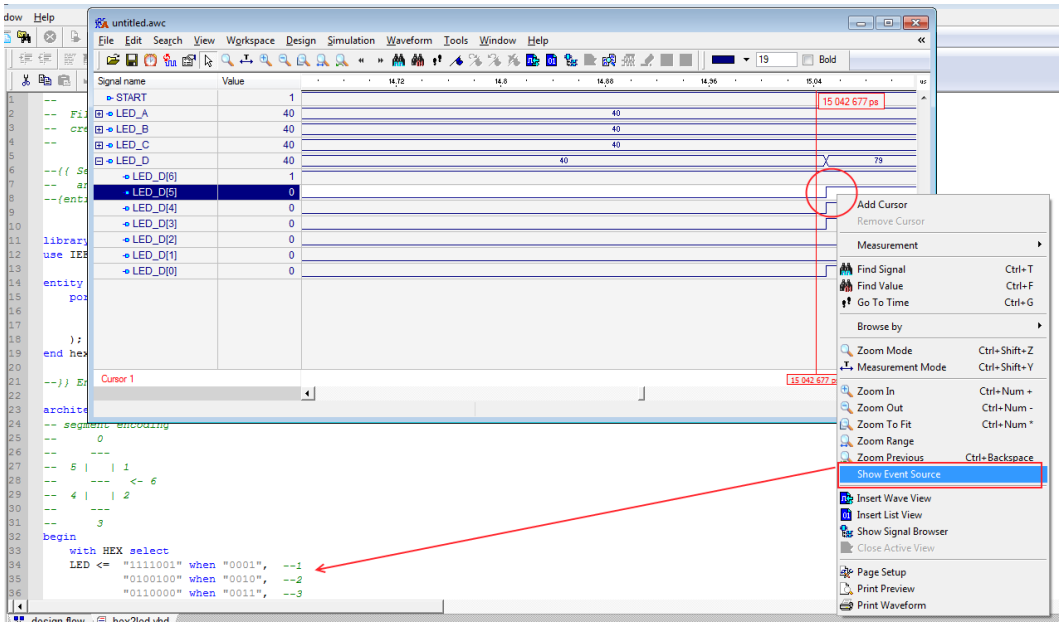

Figure 4 Show event source

The **Show Event Source** functionality involves some simulation overhead; therefore it is disabled by default. To enable the Show Event Source functionality, invoke the simulator using the `-ses` argument in the `asim` command. If you use the GUI to initialize simulation, make sure that the **Enable show event source** option is selected on the **Design | Settings… | Simulation | Trace/Debug** tab.

Signal properties

You may change signal (object) display properties by right clicking on the signal name and selecting Properties from the pop-up menu.

Radix lets you select how values HDL/SystemC objects and C/C++ variables are displayed on the waveform.

Reverse Order option makes the LSB to become the MSB and vice versa.

Notation changes the display of floating values. Available options include: Auto, Fixed, and Scientific. Setting this option is available only for floating variables.

Alias assigns aliases (mnemonics) to values of a selected item. Aliases are defined in the Alias Manager. By clicking on **Edit Aliases…** button you can open Alias Manager.

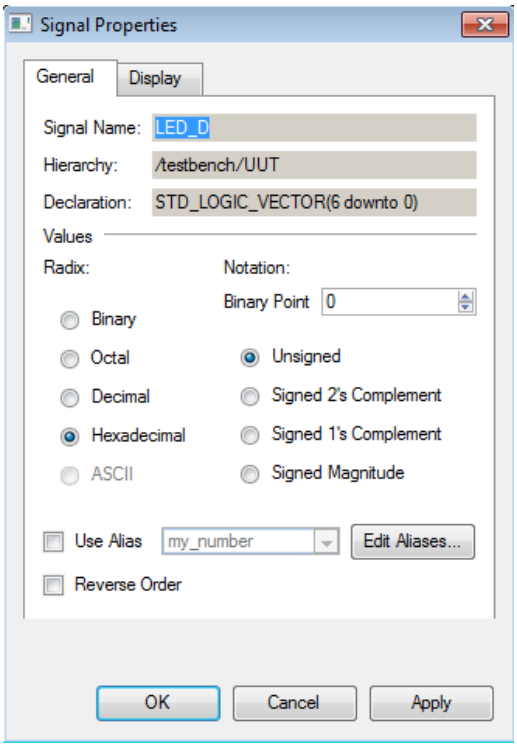

Figure 5 Signal properties General tab

The Display tab lets you configure the height of each individual waveform signal its' color and its' shape. If you want the color setting to be applied to the name of the signal as well as the signal waveform you have to uncheck Default waveform color check box.

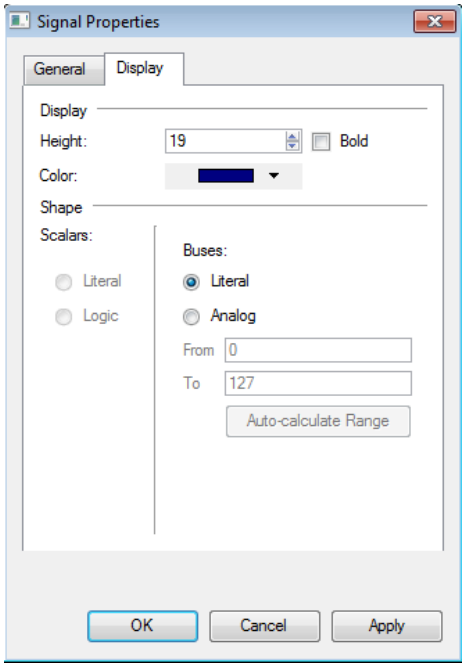

Figure 6 Signal properties Display tab<Figure name missing>

In the Analog section you may select the display value range for a signal using From and To boxes. Values less than the low bound or greater than the high bound will be "trimmed". Signal range can be calculated automatically with the **Zoom to fit** button on the Analog Toolbar.

Grouping signals

You may group your waveform signals and busses into the virtual objects of the following type:

- Virtual array
- Virtual group
- Virtual record
- Group by Hierarchy

To create a virtual object, select members of the virtual element, right-click on the selection, and choose Create Virtual **Bus**, Virtual **Group, Group by Hierarchy** from context menu. A new virtual object will be inserted at the position of the object recently selected.

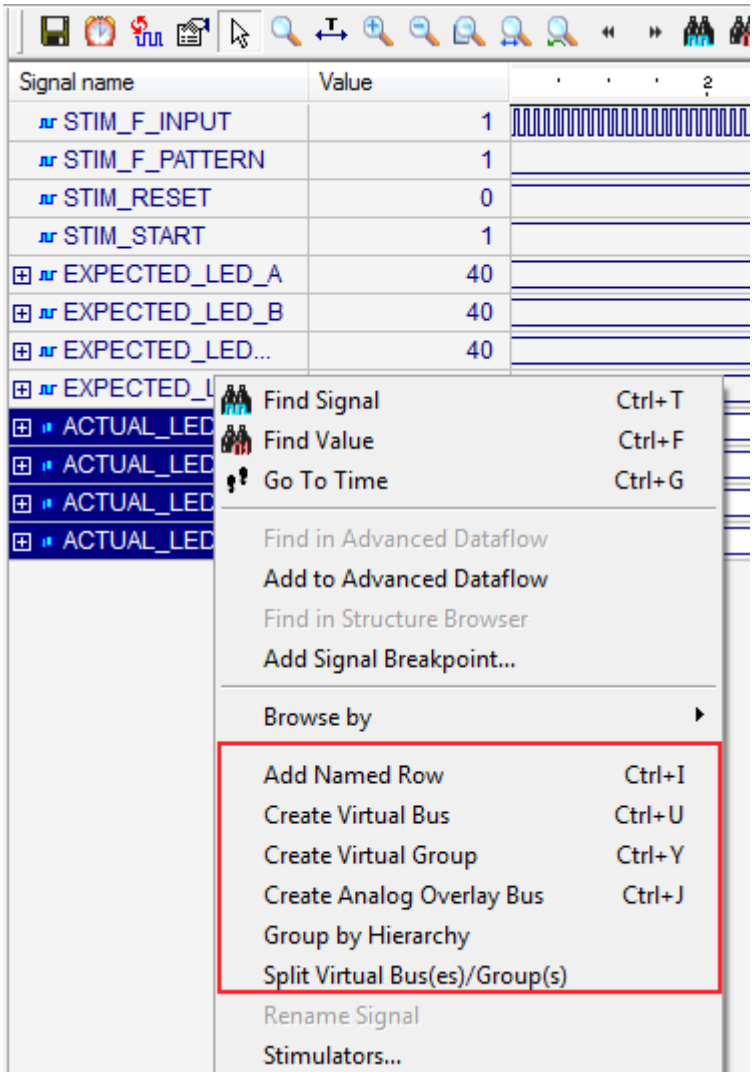

Figure 7 Grouping signals

A **Virtual Bus** is an object that allows combining elements of different types. The Value column displays the detailed information about the values of the record elements (the values are separated by spaces).

Scalars and vectors presented in the Waveform Viewer window can also be grouped. The Waveform Viewer does not show the value of the **Virtual Group** in the Value column. The value of the individual members can be checked after a virtual object is expanded.

Named rows

A named row is a single row that does not display any timing data. Such a row is a graphical object that can be useful when you need to add additional textual information to the waveforms, comment or separate selected groups of objects, etc.

In order to insert a named row, choose the **Add Named Row** option from the context menu available upon the right clicking in the signal objects area. Once the named row is inserted, the Waveform Viewer turns on the edit mode and you can change the default object name. Pressing the Esc or Enter keys or clicking anywhere within the waveform window exits the edit mode and accepts the default object name. At any time, any virtual object can be renamed manually using the Rename option from the context menu.

Searching for values or signal names

You can search the Waveform Viewer either for a specific value or an object (i.e. signal, bus, etc) name. To start the search, open the **Find** dialog box by clicking on the **Find Value** button either on the waveform Toolbar or in the context menu. The dialog box brings up with the **Find Value** tab active. If no objects in the Waveform Viewer window are selected, the search will operate on all displayed objects. If some objects are selected, the search will operate on selected objects only.

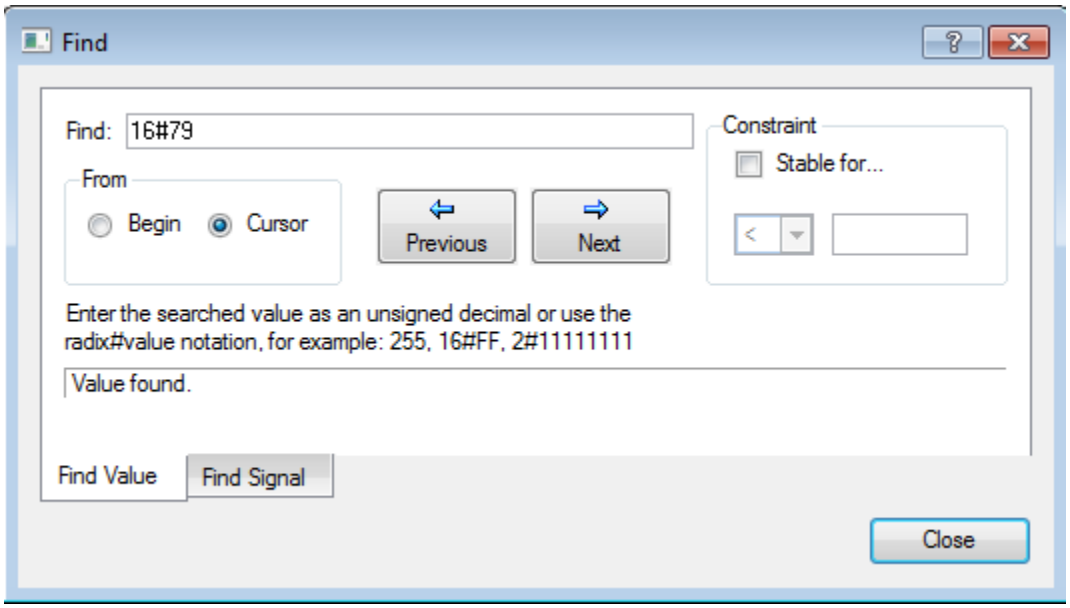

Figure 8 Find value box

Comparing waveforms

The Compare Waveforms button compares waveforms displayed in the waveform window (referred to as original waveforms) with pattern waveforms from a specific waveform file. Once you have made a comparison, you can apply changes to the original waveforms or ignore them.

Comparison of the separate databases (i.e. all waveforms that are stored in two separate datasets) does not require opening the waveform files and displaying compared objects in the Waveform Viewer window prior to comparing the databases. In case you want to compare only selected signals, one database must be loaded and a reference object must be selected in the waveform. In order to start comparing

waveforms, use one of the below options available on the Toolbar or through the **Waveform | Compare Waveform** menu:

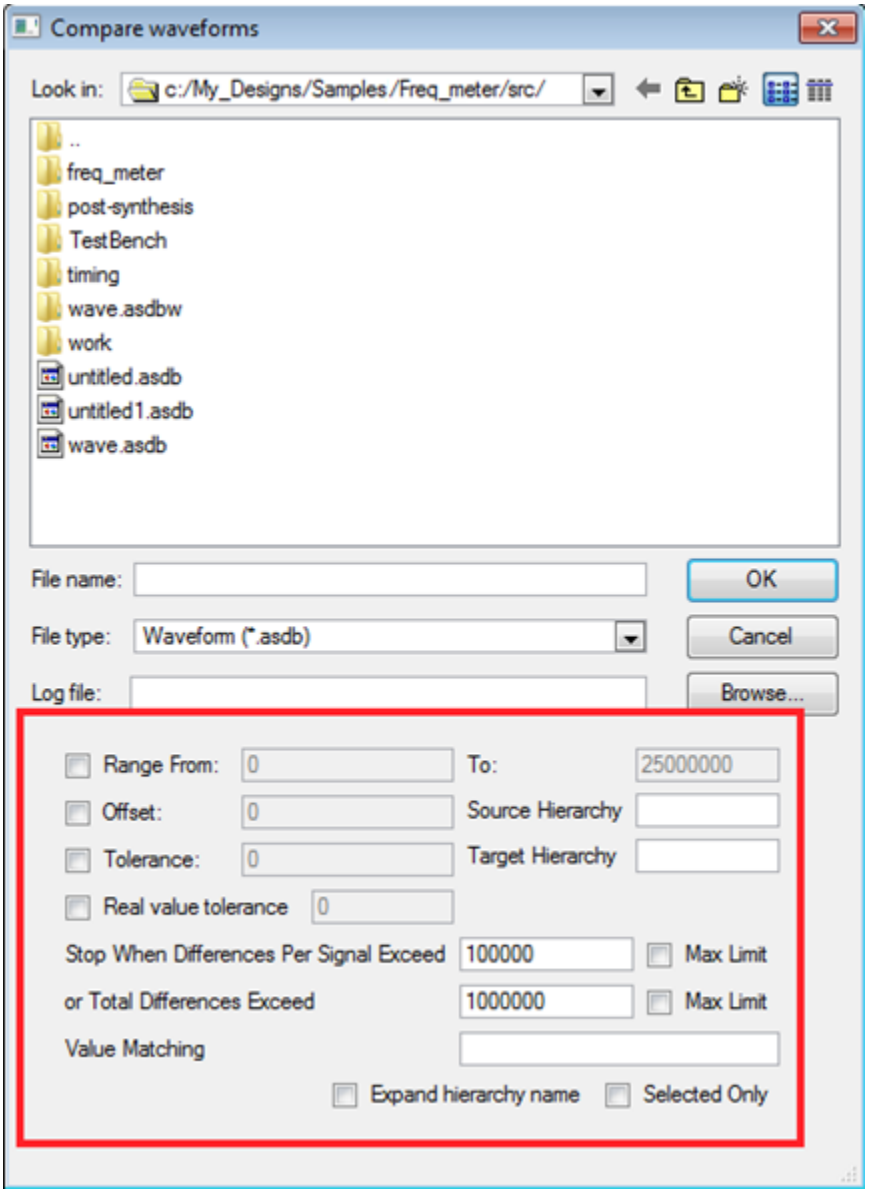

Figure 9 Waveform comparison settings

The comparison process can be customized by specifying additional options such as the comparison time range (**Start/End time**), tolerance of the comparison (**Tolerance**) expressed in the time value, a number of differences per object (**Stop When Differences per Signal Exceed**), or a total number of differences (**Total Difference Exceed**) that, if exceeded, will terminate the comparison process. The **Source / Target Hierarchy** section defines the design regions to compare for the reference and compared datasets (when comparing two datasets). The difference encountered during the comparison is denoted by using the difference marks (blue horizontal lines) located over the pair of the compared objects. The compared waveform is displayed under the reference one (from the current simulation).

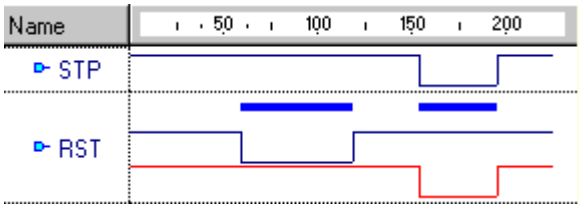

Figure 10 Mark showing difference in waveforms

The difference marks automatically inserted during the comparison can be removed by using the Remove Difference Mark buttons on the Toolbar.

Waveform Viewer shortcuts

Key Combination	Action
`Ctrl+ Mouse Wheel`	Zoom the Waveform in (scroll up) or zoom out (scroll down)
`Ctrl+ Mouse Left Key Stroke`	Selects the range and zooms in that range when zoom mode is enabled.
`Ctrl+Shift+ Mouse Wheel`	Scroll the Waveform right (scroll up) or left (scroll down); the Waveform is scrolled by pages
`Shift+Mouse Wheel`	Scroll the Waveform right (scroll up) or left (scroll down); the scroll step is the same as when hitting an arrow on the scroll bar
`Ctrl+ '+'`	Zoom the Waveform in.
`Ctrl+ '-'`	Zoom the Waveform out.
`Ctrl+ '*'`	Adjusts the zoom factor so that the complete simulation range is shown.
`Shift+ Right Arrow`	Expand signal selection.
`Shift+ Left Arrow`	Shrink signal selection.
`Ctrl+ 1`	Change the browse object to page (See help for different browsing objects)
`Ctrl+ 2`	Change the browse object to bookmark.
`Ctrl+ 7`	Change the browse object to cursor.
`Ctrl+ A`	Select all signals.
`Ctrl+ F`	Show the **Find** dialog box. The **Find Value** tab will be active.
`Ctrl+ G`	Shows the **Go to Time** dialog box.

Ctrl+ J	Insert a virtual record
Ctrl+ O	Show the dialog box for opening files.
Ctrl+ S	Save the *.awc* file
Ctrl+ T	Show the **Find** dialog box. The **Find Signal** tab will be active.