

# ModelSim SE/PE and QuestaSim in Libero SoC User Guide



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# Introduction

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Libero SoC includes the ModelSim ME simulator, which is specially designed for integration with Microsemi's Libero SoC. No special user action is required to use this version of ModelSim in Libero SoC.

To take advantage of the more advanced features available only with ModelSim SE/PE or QuestaSim, consider plugging ModelSim SE/PE or QuestaSim into the Libero SoC environment. These advanced simulation features, which may require special licensed features from Mentor Graphics, include:

- Faster simulation speed
- Mixed-Language simulation
- Advanced Optimizations
- Performance Analyzer
- C Debugger
- Dataflow Window
- Saving and Comparing Simulation Waveform
- Code Coverage
- Standalone Viewer
- System C
- Assertions (PSL)

Refer to the Reference Manual (ModelSim or QuestaSim > Help > SE Documentation > PDF Bookcase) for details about the advanced feature set.

For a comparison of the different feature sets available with different ModelSim editions, refer to:

[http://www.mentor.com/products/fv/modelsim/upload/ModelSimDE\\_Compare.pdf](http://www.mentor.com/products/fv/modelsim/upload/ModelSimDE_Compare.pdf)

This User Guide describes the steps required prior to using ModelSim SE/PE or QuestaSim in the Libero SoC environment to run simulation on your design targeted for Microsemi SmartFusion2, IGLOO2, RTG4, and PolarFire devices.

# 1 – ModelSim SE/PE and QuestaSim in the Libero SoC Environment

The steps to set up ModelSim SE/PE or QuestaSim in the Libero SoC environment are:

- Set up the license to use the ModelSim SE/PE Edition or QuestaSim.
- Compile the Microsemi simulation libraries with ModelSim SE/PE or QuestaSim.
- Create the tool profile in Libero SoC to use ModelSim SE/PE or QuestaSim.
- Edit the path to the simulation library location.
- Create a user-defined run.do file to drive simulation.

## ModelSim SE/PE and QuestaSim License Setup

The Libero SoC license from Microsemi does not work with ModelSim PE/SE or QuestaSim. To use ModelSim SE/PE or QuestaSim in the Libero SoC environment, configure the licensing for ModelSim PE/SE or QuestaSim with a license from Mentor Graphics. For details, refer to the ModelSim SE/PE Installation and Licensing Guide from Mentor Graphics:

[http://vk.drlnet.dyndns.org/help/modelsim/pdfdocs/modelsim\\_se\\_install.pdf](http://vk.drlnet.dyndns.org/help/modelsim/pdfdocs/modelsim_se_install.pdf)

## Simulation Libraries Compiled with ModelSim SE/PE and QuestaSim

To run ModelSim SE/PE or QuestaSim in the Libero SoC environment, Microsemi recommends using the Microsemi simulation libraries compiled with ModelSim SE/PE or QuestaSim to take advantage of the faster simulation speed. The factory pre-compiled simulation libraries shipped with the Libero SoC software are compiled with ModelSim ME or QuestaSim. These pre-compiled libraries work with ModelSim SE/PE or QuestaSim, but the simulation speed will be slower when compared to the native ModelSim SE/PE or QuestaSim simulation libraries.

### Simulation Libraries on the Web

Microsemi has pre-compiled the SmartFusion2/IGLOO2/RTG4/PolarFire libraries with specific ModelSim SE/PE or QuestaSim versions and other third-party simulators. They are available for download from <http://www.microsemi.com/products/fpga-soc/design-resources/design-software/libero-soc/mentor-compiled-simulation-libraries>. If a specific ModelSim SE/PE or QuestaSim version on a specific platform (Windows or Linux) is desired and there are no pre-compiled libraries for that version/platform available on the web for download, contact Microsemi Technical Support at [soc\\_tech@microsemi.com](mailto:soc_tech@microsemi.com) to request the compiled libraries for the specific ModelSim SE/PE or QuestaSim versions and the specific platform.

### Compiling Simulation Libraries on Your Own

To compile the simulation libraries independently for use with a specific ModelSim SE/PE or QuestaSim version, the Verilog source for IGLOO2 and SmartFusion2 is installed with Libero SoC and located in:

- <LiberoSoC\_installation>/Designer/lib/vlog/smartfusion2.v. (Windows)
- <LiberoSoC\_installation>/lib/vlog/smartfusion2.v. (Linux)

Use this source Verilog file to compile the simulation library for both SmartFusion2 and IGLOO2. This file exists in the Libero SoC installed location regardless of whether or not ModelSim ME or QuestaSim simulator is installed with Libero SoC.

**Note:** IGLOO2 and SmartFusion2 share the same simulation source and only Verilog is available. For IGLOO2, use smartfusion2.v file as source. There is no VHDL simulation source for IGLOO2 and

SmartFusion2. This is not a problem, because ModelSim SE/PE and QuestaSim support mixed language simulation.

To compile the simulation libraries independently for use with a specific ModelSim SE/PE or QuestaSim version, the Verilog source for RTG4 is installed with Libero SoC and located in:

- <LiberoSoC\_installation>/Designer/lib/vlog/rtg4.v. (Windows)
- <LiberoSoC\_installation>/lib/vlog/rtg4.v. (Linux)

To compile the simulation libraries independently for use with a specific ModelSim SE/PE or QuestaSim version, the Verilog source for PolarFire is installed with Libero SoC and located in:

- <LiberoSoC\_installation>/Designer/lib/vlog/polarfire.v. (Windows)
- <LiberoSoC\_installation>/lib/vlog/polarfire.v. (Linux)

**Note:** The smartfusion2.v, rtg4.v, and polarfire.v Verilog sources include simulation models for the library cells and logic blocks in the FPGA fabric. It does not include simulation models for advanced blocks such as MSS, DDR, SerDes, XCVR, and PCIe. If the design for simulation contains advanced blocks, use the pre-compiled libraries shipped with Libero SoC which supports MSS, FDDR and SerDes simulation. In addition, simulation libraries compiled with ModelSim SE are available for download from the Microsemi website <http://www.microsemi.com/products/fpga-soc/design-resources/design-software/libero-soc/mentor-compiled-simulation-libraries>. These Modelsim SE/PE and QuestaSim based pre-compiled libraries support advanced blocks such as DDR, MSS, XCVR, SerDes, and PCIe simulation, and they run faster than the Modelsim ME pre-compiled libraries shipped with Libero SoC. If the SE/PE-based pre-compiled simulation library available for download from the Microsemi website is not the desired version, contact Microsemi Technical Support at soc\_tech@microsemi.com to request the version-specific simulation library.

## Simulation Library Compilation Steps

Follow these steps to compile your own simulation libraries for SmartFusion2 and IGLOO2:

1. Create the "Microsemi" folder/directory under <ModelSim or QuestaSim\_installed\_location>  

```
mkdir <ModelSim or QuestaSim_install_location>/Microsemi
```
2. Invoke ModelSim SE/PE or QuestaSim Graphical Interface  

```
Start > ModelSim SE/PE or QuestaSim <version>
```
3. In the Transcript window at the ModelSim or QuestaSim command prompt, change to the Microsemi folder  

```
> cd <ModelSim or QuestaSim_install_location>/Microsemi
```
4. Create the folders to store the compiled libraries  

```
ModelSim or QuestaSim> vlib smartfusion2
ModelSim or QuestaSim> vlib igloo2
ModelSim or QuestaSim> vlib rtg4
ModelSim or QuestaSim> vlib polarfire
```
5. Map the simulation library location to the simulation library name  

```
vmap smartfusion2 <ModelSim_Install_Path>/Microsemi/smartfusion2
vmap igloo2 <ModelSim or QuestaSim_Install_Path>/Microsemi/igloo2
vmap rtg4 <ModelSim or QuestaSim_Install_Path>/Microsemi/rtg4
vmap polarfire <ModelSim or QuestaSim_Install_Path>/Microsemi/polarfire
```
6. Compile the simulation libraries from the Verilog source  

```
vlog -work smartfusion2 "<Libero_Install_Path>/Designer/lib/vlog/
smartfusion2.v"
vlog -work igloo2 "<Libero_Install_Path>/Designer/lib/vlog/smartfusion2.v"
vlog -work rtg4 "<Libero_Install_Path>/Designer/lib/vlog/rtg4.v"
vlog -work polarfire "<Libero_Install_Path>/Designer/lib/vlog/polarfire.v"
```

**Note:** For IGLOO2 devices, use smartfusion2.v as the source.

The library compilation steps may be put in a script file "compile\_lib.do" as follows:

```
mkdir "D:/<ModelSim or QuestaSim_install_location>/Microsemi"
cd "D:/<ModelSim or QuestaSim_install_location>/Microsemi"
vlib smartfusion2
vlib igloo2
```

```

vlib rtg4
vlib polarfire
vmap smartfusion2 smartfusion2
vmap igloo2 igloo2
vmap rtg4 rtg4
vmap polarfire polarfire
vlog -work smartfusion2 "D:/<Libero_Install_Path>/Designer/lib/vlog/
smartfusion2.v"
vlog -work igloo2 "D:/<Libero_Install_Path>/Designer/lib/vlog/smartfusion2.v
vlog -work rtg4 "D:/<Libero_Install_Path>/Designer/lib/vlog/rtg4.v"
vlog -work polarfire "D:/<Libero_Install_Path>/Designer/lib/vlog/polarfire.v

```

Before running any design simulations, execute the script once at the ModelSim or QuestaSim prompt to compile the simulation libraries as follows:

```
> do compile_lib.do
```

## Simulator Version and Simulator Library Version

There is a compatibility dependency between the simulation library version and the ModelSim or QuestaSim simulator version. The compiled simulation library version needs to be the same version as the ModelSim simulator. Whenever the ModelSim or QuestaSim simulator version differs from the library version by a number instead of only a letter, refresh the simulation libraries. For example, ModelSim v10.3a and v10.3c can use the same compiled libraries. However, moving to ModelSim v10.4c requires a refresh of the simulation libraries. ModelSim may give an error if the simulation library is not refreshed:

*This version of the compiler is incompatible with the library file .....*

To refresh the simulation libraries, at the ModelSim or QuestaSim prompt, run the vlog command with the -refresh option as follows:

```

> vlog -refresh -work smartfusion2
> vlog -refresh -work igloo2
> vlog -refresh -work rtg4
> vlog -refresh -work polarfire

```

**Note:** This command requires write permission to the simulation library location. The refresh fails if there is no write permission to the simulation library location.

To refresh the library alternatively, go to the Library tab in ModelSim or QuestaSim, right-click the library to be refreshed and select **Refresh**.

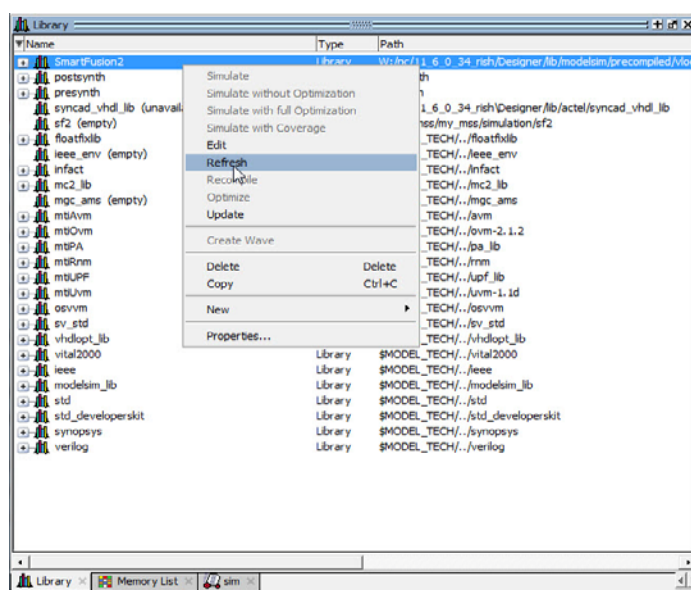


Figure 1-1 • Simulation Library Refreshed

**Note:** Refreshing the simulation libraries is not guaranteed to always work, depending on libraries and simulators used. If it does not work, you may need to request the library or libraries.

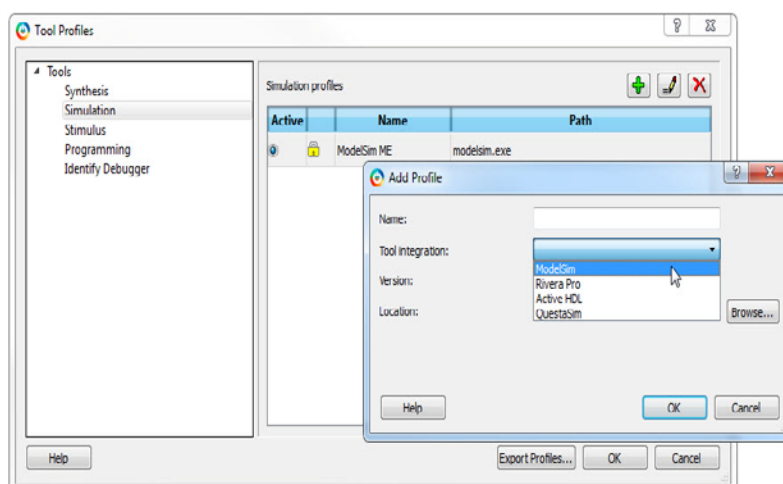
For example, 10.3a and 10.3c libraries are compatible, but 10.3c libraries may not work in a 10.4a simulator.

## Setting Libero SoC Tool Profile

By default, the Libero SoC tool profile (**Project > Tool Profile > Simulation**) is set up to invoke ModelSim ME, which is integrated into Libero SoC. To use ModelSim SE/PE Edition or QuestaSim from Mentor Graphics, set up the simulation tool profile so that Libero SoC invokes ModelSim SE/PE or QuestaSim instead of the default ModelSim ME.

Follow these steps to set up the simulation tool profile for ModelSim SE/PE or QuestaSim:

1. Invoke the **Tool Profile Setup** dialog box (**Project > Tool Profile**).
2. Click **Simulation**.
3. Click the **Add Profile** (green) icon. The Add Profile dialog box appears.

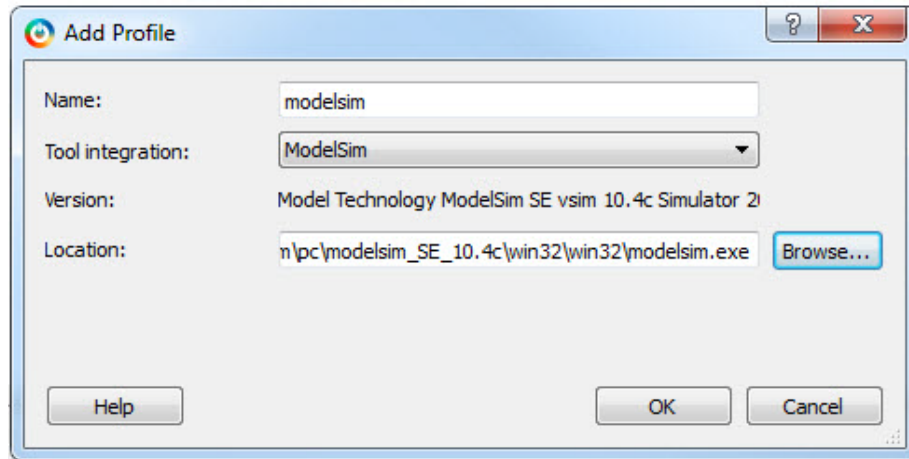


**Figure 1-2 • Tool Profile**

4. Enter ModelSim\_SE/PE <version> or QuestaSim <version> in the Name field.
5. Select ModelSim or QuestaSim from the pull-down list in the Tool Integration field.



- Click **Browse** to navigate to the location of the modelsim.exe or questasim.exe.



**Figure 1-3 • Add Tool Profile**

- Click **Open** to accept the modelsim.exe or questasim.exe path.
- Click **OK** to exit the **Add Profile** dialog box.

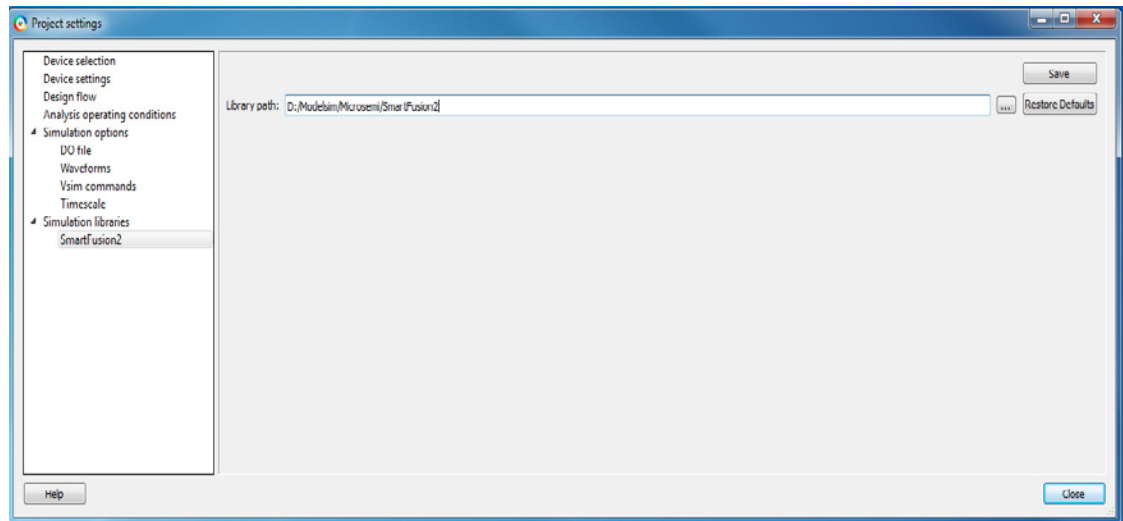
## Setting Simulation Library Path to Non-Default Location

Libero SoC sets the simulation library by default to <LiberoSoC\_installation>/Designer/lib/modelsim/precompiled/<vlog | vhd>/SmartFusion2 for both SmartFusion2 and IGLOO2 projects. This is the default location of the pre-compiled simulation library shipped with Libero SoC. To use the simulation library compiled independently with Modelsim SE/PE or QuestaSim, change the simulation library path from the default location to the location of the libraries independently compiled. If the simulation library is downloaded or requested from Microsemi Technical Support, change the library location to that of the downloaded/requested library.

To change the simulation library location:

- From the Libero SoC Project menu, click Project Settings and then SmartFusion2 or IGLOO2 under Simulation Libraries (**Project > Project Settings > Simulation Libraries > SmartFusion2/IGLOO2**).
- Click the browse/navigation button to navigate to the location of the simulation libraries to use.

3. Select the location and then click **Save**. The library path field now appears in the new library path.



**Figure 1-4 • Simulation Library Path**

## User-defined DO file

By default, Libero SoC generates a run.do file and passes it to ModelSim or QuestaSim to run simulation. This file will be generated and overwritten every time ModelSim or QuestaSim is invoked from Libero SoC.

ModelSim SE/PE and QuestaSim offer advanced features such as dataflow window and C Debugger, which are not available in ModelSim ME and therefore not included in vsim commands in the default run.do file. To take advantage of these advanced features, create a user-defined Do file and put the command switches for these advanced features in the user-defined Do file. Save the user-defined Do file in the Simulation folder of the Libero SoC project. Unlike the default run.do file, this user-defined Do file is not overwritten every time ModelSim or QuestaSim is invoked from Libero SoC.

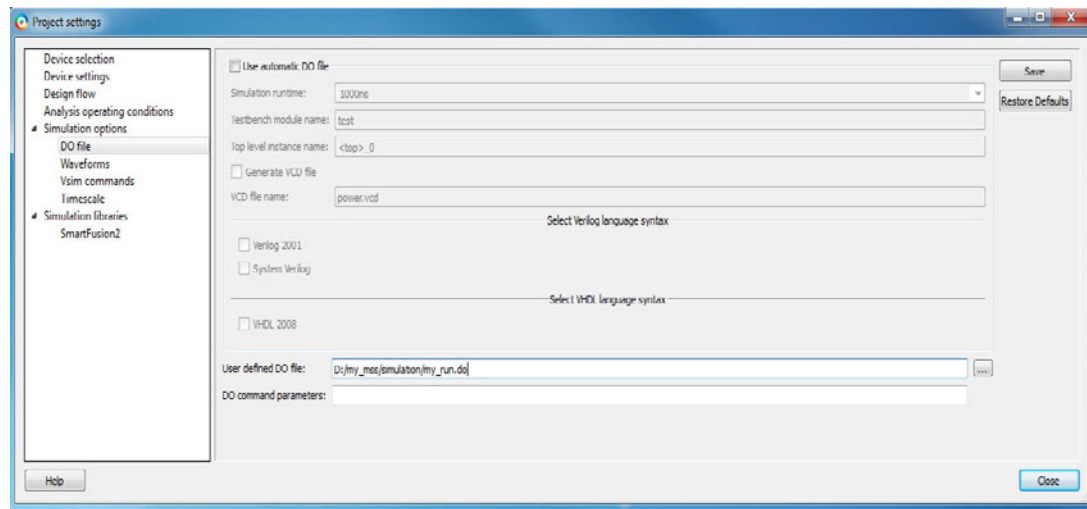
## Creating the User-Defined Do File

1. Invoke ModelSim SE/PE or QuestaSim from Libero SoC (**Design Flow Window > Verify Post-Synthesis Implementation > Double-click Simulate**). Libero SoC creates the run.do file and invokes ModelSim SE/PE or QuestaSim.
2. Exit ModelSim SE/PE or QuestaSim simulation.
3. Click the Files tab in Libero SoC.
4. Expand the Simulation folder in the Files tab.
5. Double-click the run.do file to open it in the Libero SoC Editor.
6. Edit the run.do file. Include vsim advanced command switches such as -postsimdataflow or debugdb:
 

```
vsim -postsimdataflow -debugdb=<db_pathname> -wlf <db_pathname>
add log -r /*
```
7. Save the file with a different name (for example, my\_run.do).

## Running ModelSim SE/PE or QuestaSim with the User-defined Do File

1. From Libero SoC Project menu, click Project Settings and click DO file under Simulations (**Project > Project Settings > Simulations Options > DO file**).
2. Uncheck the “use automatic DO file” option.
3. Click the browse button to navigate to the /<Proj\_location>/Simulation/myrun.do file. Select the file and click **Open**.
4. The user-defined “my\_run.do” file path appears in the User-defined Do File field.



**Figure 1-5 • Project Settings and Simulations Options**

5. Click **Save** to exit.

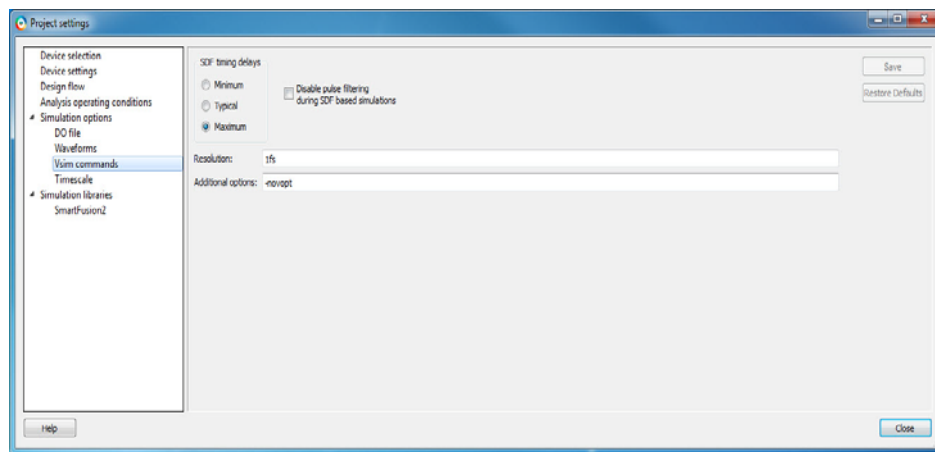
The next time ModelSim SE/PE or QuestaSim is invoked from Libero SoC, the file “my\_run.do” is executed to run simulation.

## ModelSim SE/PE or QuestaSim Simulation with Libero SoC Factory Pre-Compiled Libraries

The pre-compiled simulation libraries shipped with Libero SoC are factory-compiled with Modelsim ME. They work with Modelsim SE/PE and QuestaSim in the Libero SoC environment. However, with the pre-compiled libraries, there is no speedup in simulation runtime, which is available only with the native ModelSim SE/PE and QuestaSim simulation libraries.

Take these steps before running ModelSim SE/PE or QuestaSim with the factory pre-compiled simulation libraries in Libero SoC:

1. Set up the licensing to run ModelSim SE/PE or QuestaSim with a license from Mentor Graphics.
2. Set up the Libero SoC Tool Profile to run ModelSim SE/PE or QuestaSim.
3. Make sure that there is write permission to the location of the factory pre-compiled simulation libraries.
4. Use the -novopt option in the vsim command to disable optimization. The Optimization feature is enabled by default in ModelSim SE/PE and QuestaSim. To set the vsim -novopt/-vopt options, click **Project > Project Settings > Vsim Commands** and enter “-novopt” or “-vopt” in the Additional Options field. This option will be included in the run.do file when Libero SoC generates the file for the simulation run.

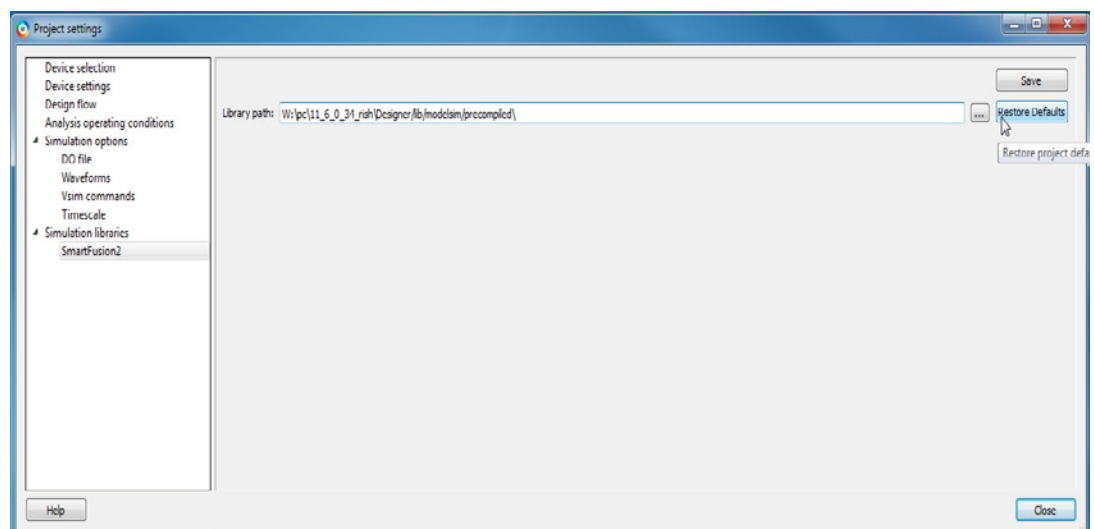


**Figure 1-6 • Adding vsim -novopt options**

Alternatively, include this option in the user-defined “my\_run.do” to run simulation:

```
vsim -L SmartFusion2 -L postsynth -t 1fs -novopt postsynth.test
```

5. Click SmartFusion2, IGLOO2, RTG4, or PolarFire under Simulation Libraries.
6. Click **Restore Default**. This will restore the simulation library path to the default location, which is where the factory pre-compiled libraries reside.



**Figure 1-7 • Setting Simulation Library Path Location**

**Note:** For the default pre-compiled library to appear, ModelSim ME and the pre-compiled simulation libraries must be installed.

## Summary

Table 1-1 is a matrix of the different combinations of Simulator Editions and Simulation Libraries. The advantages and disadvantages of each combination and the user actions are listed for comparison.

**Table 1-1 • ModelSim Editions and Simulation Library Matrix**

ModelSim Editions	Simulation Libraries		
	Factory pre-compiled with Modelsim ME and shipped with Libero	Simulation library downloaded from Microsemi website	User-compiled library with ModelSim SE/PE or QuestaSim from source in Libero
ModelSim ME (Default simulator shipped with Libero)	Default Libero Simulator. No user setup required. Supports MSS, FDDR, and SerDes components. Slower simulation speed. No advanced simulation features.	Incompatible with simulation library compiled with ModelSim SE/PE or QuestaSim.	Incompatible.
ModelSim SE/PE QuestaSim	Non-default simulator in Libero SoC. Tool profile setup needed. Separate license direct from Mentor Graphics required. Supports MSS, FDDR, and SerDes components in the design. Slower simulation speed. Advanced features of ModelSim SE available if licensed. Need to run with the vsim -novopt switch because of simulation library limitations.	Non-default simulator in Libero SoC. Tool profile setup required. Simulation library path setup required. Download from <a href="https://www.microsemi.com/product-directory/libero-soc/5081-mentor-compiled-simulation-libraries">https://www.microsemi.com/product-directory/libero-soc/5081-mentor-compiled-simulation-libraries</a> or request simulation library from Microsemi Tech Support: <a href="mailto:soc_tech@microsemi.com">soc_tech@microsemi.com</a> Faster simulation speed. Supports MSS, FDDR, and SerDes components in the design. Advanced vsim command switches available if licensed from Mentor Graphics.	Non-default simulator in Libero SoC. Tool profile setup required. User compilation of simulation library required using Verilog sources from Libero installation. Need simulation library path setup to non-default location. Faster simulation speed. No support for MSS, FDDR, and SerDes components in the design. Advanced vsim command switches available if licensed from Mentor Graphics.