VCS Unreachability Analysis (UNR)
Lab Setup and Standard Usage

Learning Objectives

In this VCS UNR, you will use a traffic light controller example to learn to do the following:

- Run simulation to generate coverage database

- Set up to enable VCS Unreachability Analysis (UNR)

- Run VCS UNR on items uncovered from simulation coverage database

- Generate exclusion file for items found uncoverable by UNR

Familiarity with VCS coverage, knowledge of exclusion mechanism and basic formal verification concept are required for this lab.

Lab Duration:
20 minutes

Files Location

All files for this VC Formal lab are in directory:
$VC_STATIC_HOME/doc/vcst/examples/FCA/VCS_UNR/

Directory Structure	
VCS_UNR	Lab main directory
README_VCS_UNR.pdf	Lab instructions
design/	Verilog RTL code of the Device Under Test (DUT)
tb/	Testbench for the traffic light controller
run/	Run directory
solution/	Solution directory

Resources

The following resources are available for in-depth guidance regarding VC Formal usage, commands, and variables.

VC Formal User Guide:
$VC_STATIC_HOME/doc/vcst/VC_Formal_Docs/VC_Formal_UG.pdf

VC Formal Apps Quick References Guides:
$VC_STATIC_HOME/doc/vcst/VC_Formal_Docs/Quick_Reference_Guides/

VC Formal Apps Tcl Templates:
$VC_STATIC_HOME/doc/vcst/VC_Formal_Docs/Quick_Reference_Guides/vcf_tcl_templates/

Prepare your Environment

1. Set environment variable pointing to your VCS installation directory:

```
%setenv VCS_HOME /tools/synopsys/vcs
```

2. Add path $VCS_HOME/bin to the PATH environment variable.

3. Change your working directory to VCS_UNR/run:

```
%cd VCS_UNR/run
```

Now you are ready to begin the lab.

Create Script for VCS Simulation

Setting up to run simulation in VCS quite common starts with a shell file to set up and compile a design, testbench and run. In this step, you will create a file to do just that.

The DUT files and a file list "filelist_sim" are located under VCS_UNR/design. Testbench file is located under VCS_UNR/tb. Upon examining the files, you will see that the hierarchy structure is:

    top level module name (testbench): TB
        Instance of traffic : T1
                ……

4. Open a new file run.csh (any arbitrary name is ok to use) using any text editor:

```
%vi run.csh
```

5. Add command for VCS simulation to compile; with line, condition, toggle and fsm coverage metrics enabled as well as option to start run automatically after compile.

```
vcs -f ../design/filelist_sim -cm line+cond+tgl+fsm -R
```

6. Run the script to invoke VCS simulator and run the simulation

```
%chmod +x run.csh
%./run.csh
```

You should see coverage database simv.vdb has been generated.

Create Config File for VCS UNR

Now that you have run the VCS Simulation and have results on the coverage targets based on the specified metrics, the next step is to set up a configuration file so that unreachability analysis

using formal technology can be done to see how many of the coverage targets that are marked "uncovered" are actually not possible to be covered with any stimulus.

7. Open a new file unr_config.txt (any arbitrary name is ok to use) using any text editor:

```
%vi unr_config.txt
```

8. The required parameters to specify in the configuration file for traffic light are:
    DUT top = traffic
    Input simulation coverage database = simv.vdb
    Instance name of the DUT top in the testbench = TB.T1
    Clock = clk , clock period 100
    Reset = rst , active high

    Add the following lines to specify these in the unr_config.txt file:

```
-top traffic
-covInput simv.vdb
-covDUT TB.T1
-clock clk 100
-reset rst 1
```

Modify the Run File to Add VCS UNR

With the configuration file done, the next step is to modify the VCS simulation run file to enable the VCS UNR run.

9. Open and edit run.csh:

```
%vi run.csh
```

10. Add option to enable running VCS UNR.

```
vcs -f ../design/filelist_sim -cm line+cond+tgl+fsm \
-unr=unr_config.txt -R
```

11. Run VCS UNR

```
% ./run.csh
```

Note:

   After run has finished (should be less than 5 minutes), the uncoverable coverage targets will be saved in **unreachables.el** file that can be read in as an exclusion file to the original coverage simv.vdb database.