

Unraveling the Complexities of Functional Coverage: An advanced guide to simplify your use model



Thom Ellis
Mentor Graphics Corporation
thomas_ellis@mentor.com

Rohit Jain
Mentor Graphics Corporation
rohit_jain@mentor.com

Top 3 Guidelines

- 1) For covergroup options, the most efficient settings will be:
 - * option.per_instance=0
 - * type_option.merge_instances=1
- 2) Get in the habit of always naming your covergroup instances.
- 3) Explicitly define a list of cross bins whenever possible, rather than relying on a tools auto-expansion features.

2) Naming Covergroups

```
package p;
class c;
  int i;
  covergroup cg(string o_name);
    option.name = o_name;
    coverpoint i { bins ival[] = { [0:1] }; }
  endgroup
  function new(string cvg_name);
    cg = new(cvg_name);
  endfunction
  function void sample(int val);
    i = val;
    cg.sample();
  endfunction
endclass
endpackage
module top;
  p::c cv = new("foo");
  p::c cv2 = new("bar");
  initial begin
    ...
  end
endmodule
```

Adding User Names

Name	Class Type	Coverage
/p/c		25.0%
TYPE cg	c	25.0%
CVP cg:i	c	25.0%
INST Vp::c:cg		50.0%
INST Vp::c:cg#2		0.0%

Tool Named Instances

Name	Class Type	Coverage
/p/c		25.0%
TYPE cg	c	25.0%
CVP cg:i	c	25.0%
INST foo		50.0%
INST bar		0.0%

User Named Instances

1) Covergroup Options

```
module top;
  covergroup cg (ref int v);
    option.per_instance = 0;
    type_option.merge_instances = 0;
    option.get_inst_coverage = 0;
    coverpoint v { bins val[] = { [0:1] }; }
  endgroup
  int a, b;
  cg cva = new(a);
  cg cvb = new(b);
  initial begin
    #1; a = 0; cva.sample();
    #1; b = 1; cvb.sample();
    #1; $display("cva=%.2f cvb=%.2f cva+cvb=%.2f",
      cva.get_inst_coverage(), cvb.get_inst_coverage(),
      cg::get_coverage());
  end
endmodule
```

Example Covergroup with Default Options

Name	Class Type	Coverage
/top		50.0%
TYPE cg		50.0%
CVP cg::v		50.0%
INST \top/cva		50.0%
CVP v		50.0%
bin val[0]		1
bin val[1]		0
INST \top/cvb		50.0%
CVP v		50.0%
bin val[0]		0
bin val[1]		1

option.per_instance=1

3) Auto-bin Expansion

```
covergroup cvg;
  a_cov: coverpoint A iff (start) {
    bins a_1 = {1};
    bins a_2 = {2};
    bins a_3 = {3};
  }
  b_cov: coverpoint B iff (start) {
    bins b_1 = {1};
    bins b_2 = {2};
    bins b_3 = {3};
  }
  c_cov: coverpoint C iff (start) {
    bins c_1 = {1};
    bins c_2 = {2};
    bins c_3 = {3};
  }

  a_b_cross :cross a_cov, b_cov{
    bins a_1_b_1 = bins_of(a_cov.a_1) && bins_of(b_cov.b_1);
    // don't auto-expand cross-bins here
  }
  a_c_cross :cross a_cov, c_cov;
  // auto-expand cross-bins here
endgroup
```

Name	Class Type	Coverage	Goal
/top		100.0%	100
TYPE cg		100.0%	100
CVP cg::v		100.0%	100
bin val[0]		1	1
bin val[1]		1	1
INST \top/cva		50.0%	100
CVP v		50.0%	100
bin val[0]		1	1
bin val[1]		0	1
INST \top/cvb		50.0%	100
CVP v		50.0%	100
bin val[0]		0	1
bin val[1]		1	1

type_option.merge_instances=1

Name	Class Type	Coverage
/top		50.0%
TYPE cg		50.0%
CVP cg::v		50.0%

Covergroup with Default Options