44th Day

Full Adder Verification Using SV

Design

```
module fa(input a,b,cin,output sum,cout);


  assign sum=a^b^cin;
  assign cout=(a&b)|(b&cin)|(cin&a);


endmodule
```

Interface

```
interface fa_intf;
  logic a;
  logic b;
  logic cin;
  logic sum;
  logic cout;
endinterface
```

Transaction

```
class transaction;


  randc bit a;
  randc bit b;
  randc bit cin;


  bit sum;
  bit cout;


  function void display(string name);
    $display("_______%s_________",name);
    $display("a=%b,b=%b,cin=%b,sum=%b,cout=%b,time=%0t",a,b,cin,sum,cout,$time);
  endfunction



endclass
```

TB_top

```
`include "interface.sv"
`include "test.sv";
module tb_top;
  fa_intf pif();
  test tb(pif);
  fa dut(.a(pif.a),.b(pif.b),.cin(pif.cin),.sum(pif.sum),.cout(pif.cout));


  initial
    begin
      $dumpfile("dump.vcd");
```

```
    $dumpvars(1);
   end

endmodule
```

Test

```
`include "env.sv"
program test(fa_intf vif);
 environment env;
 initial
   begin
    env=new(vif);
    env.run();
   end
endprogram
```

Env

```
 `include "generator.sv"
`include "driver.sv"
`include "monitor.sv"
`include "scoreboard.sv"

class environment;

  generator gen;
  driver drv;
  monitor mon;
  scoreboard scb;
```

```
  mailbox mbx1;
  mailbox mbx2;
  virtual fa_intf vif;

  function new(virtual fa_intf vif);
    this.vif=vif;
    mbx1=new();
    mbx2=new();
    gen=new(mbx1);
    drv=new(vif,mbx1);
    mon=new(vif,mbx2);
    scb=new(mbx2);
  endfunction

  task run();
    fork
      gen.run();
      drv.run();
      mon.run();
      scb.run();

    join
  endtask
endclass
```

Gen

```
`include "transaction.sv"


class generator;
  transaction tr;
  mailbox mbx;


  function new(mailbox mbx);
    this.mbx=mbx;
  endfunction


  task run();


     repeat(5)
       begin
         tr=new();
         tr.randomize();


         tr.display("generator class signals");
         mbx.put(tr);
       end


  endtask
endclass
```

Driver

```
class driver;
 virtual fa_intf vif;
 mailbox mbx;
 transaction tr;

 function new(virtual fa_intf vif,mailbox mbx);
  this.vif=vif;
  this.mbx=mbx;
 endfunction

 task run();
  repeat(5)
   begin

    mbx.get(tr);
    vif.a<=tr.a;
    vif.b<=tr.b;
    vif.cin<=tr.cin;
    #1;

    tr.display("_____driver class signals_____");
   end
 endtask
endclass
```

Monitor

```
class monitor;

 virtual fa_intf vif;

 mailbox mon2scb;

 transaction trans;

 function new(virtual fa_intf vif,mailbox mon2scb);

  this.vif = vif;
  this.mon2scb = mon2scb;
 endfunction

 task run;

  repeat(5)
   begin
   #1;
   trans = new();
   trans.a    = vif.a;
   trans.b    = vif.b;
   trans.cin   = vif.cin;
   trans.sum   = vif.sum;
   trans.cout  =vif.cout;
   mon2scb.put(trans);
   trans.display("monitor class signals");
   end
```

```
 endtask

endclass
```

Scoreboard

```
class scoreboard;

 mailbox mon2scb;

 function new(mailbox mon2scb);
  this.mon2scb = mon2scb;
 endfunction

 task run;
  transaction trans;
  forever begin
   mon2scb.get(trans);
   if((trans.a+trans.b+trans.cin) == {trans.cout,trans.sum})
    $display("Result is as Expected time = %0t", $time);
    else
      $error("Wrong Result.\n\tExpeced: %0d Actual: %0d time =
%0t",(trans.a+trans.b+trans.cin),{trans.cout,trans.sum}, $time);
       end
 endtask
 endclass
```

Simulation

```
_______generator class signals_________
a=1,b=1,cin=1,sum=0,cout=0,time=0
_______generator class signals_________
a=1,b=0,cin=1,sum=0,cout=0,time=0
_______generator class signals_________
a=1,b=1,cin=1,sum=0,cout=0,time=0
_______generator class signals_________
a=0,b=0,cin=1,sum=0,cout=0,time=0
_______generator class signals_________
a=0,b=1,cin=1,sum=0,cout=0,time=0
_____________driver class signals_______________
a=1,b=1,cin=1,sum=0,cout=0,time=1
_______monitor class signals_________
a=1,b=1,cin=1,sum=1,cout=1,time=1
Result is as Expected time = 1
_____________driver class signals_______________
a=1,b=0,cin=1,sum=0,cout=0,time=2
_______monitor class signals_________
a=1,b=0,cin=1,sum=0,cout=1,time=2
Result is as Expected time = 2
_____________driver class signals_______________
a=1,b=1,cin=1,sum=0,cout=0,time=3
_______monitor class signals_________
a=1,b=1,cin=1,sum=1,cout=1,time=3
Result is as Expected time = 3
_____________driver class signals_______________
a=0,b=0,cin=1,sum=0,cout=0,time=4
_______monitor class signals_________
a=0,b=0,cin=1,sum=1,cout=0,time=4
Result is as Expected time = 4
_____________driver class signals_______________
a=0,b=1,cin=1,sum=0,cout=0,time=5
_______monitor class signals_________
a=0,b=1,cin=1,sum=0,cout=1,time=5
Result is as Expected time = 5
           V C S   S i m u l a t i o n   R e p o r t
Time: 5 ns
CPU Time:      0.450 seconds;       Data structure size:
0.0Mb
Sat May 17 03:29:48 2025
```