If statement

```
If_statement ::= if condition then
          sequence of sequential statements
{elsif condition then
sequence of sequential statements}
[else
sequence of sequential statements]
end if;
```

If statement

```
entity IFSTMT is
  port (      RSTn, CLK, EN, PL : in  bit;
    DATA       : in  integer range 0 to 31;
    COUNT      : out integer range 0 to 31);
end IFSTMT;

architecture RTL of IFSTMT is
  signal COUNT_VALUE : integer range 0 to 31;
begin
  p0 : process (RSTn, CLK)
  begin
    if (RSTn = '0') then
      COUNT_VALUE <= 0;
    elsif (CLK'event and CLK = '1') then
       if (PL = '1') then
           COUNT_VALUE <= DATA;
       elsif (EN = '1') then
         if (COUNT_VALUE = 31) then
            COUNT_VALUE <= 0;
         else
            COUNT_VALUE <=
               COUNT_VALUE + 1;
         end if;
       end if;
    end if;
  end process;
  COUNT <= COUNT_VALUE;
end RTL;
```

If statement

Note:

- The signal COUNT is of the **OUT mode** so it cannot be read.
- A **temporary signal** COUNT_VALUE is used to calculate the COUNT value.
- Then COUNT_VALUE is assigned to the output port COUNT **outside the process.**

If statement

```
if (RSTn = '0') then
      COUNT_VALUE <= 0;
    elsif (CLK'event and CLK = '1')
then
      if (PL = '1') then
        COUNT_VALUE <= DATA;
      elsif (EN = '1') then
        if (COUNT_VALUE = 31)
then
          COUNT_VALUE <= 0;
        else
          COUNT_VALUE <=
                COUNT_VALUE + 1;
        end if;
      end if;
    end if;
```

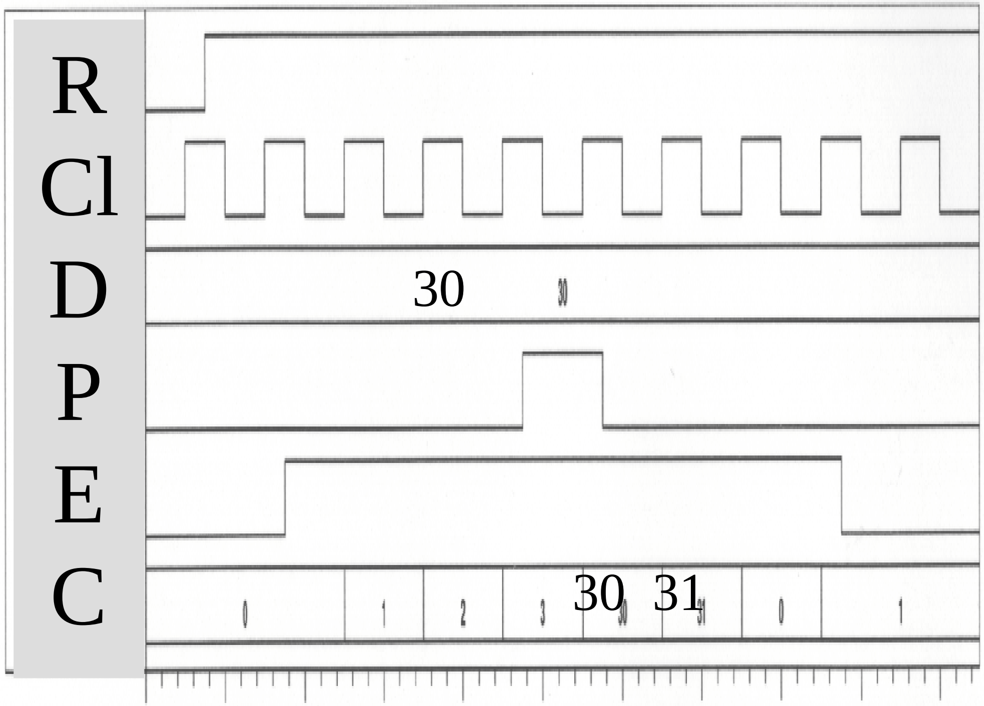
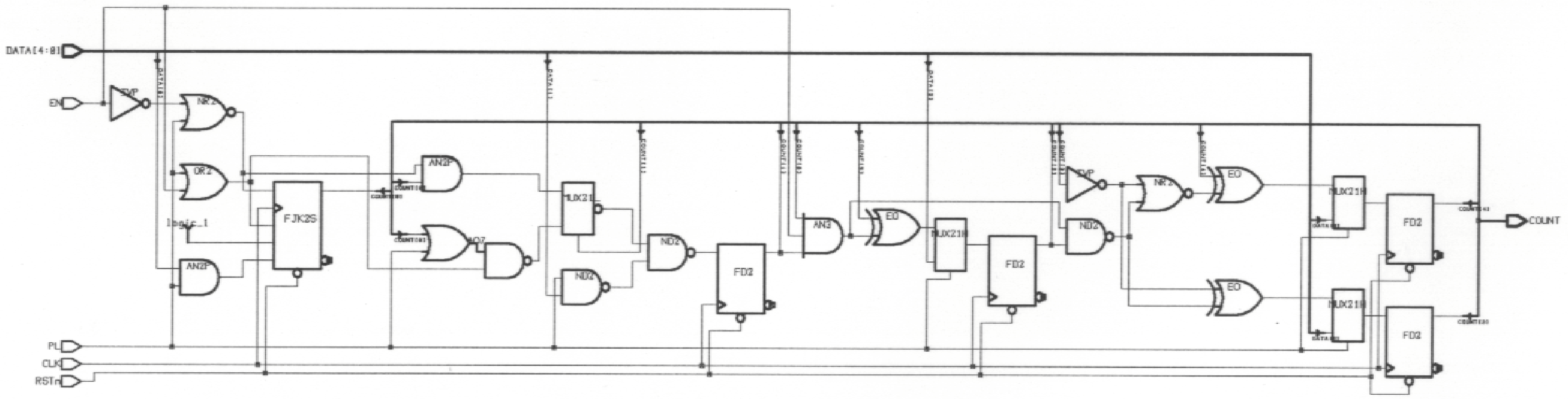


FIGURE 4.5 5-bit counter simulation waveform.

If statement



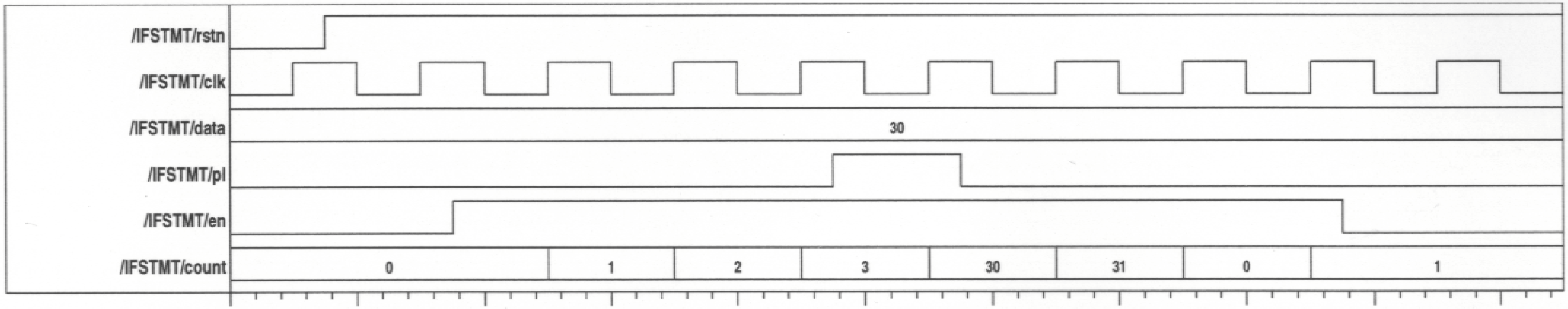


FIGURE 4.5 5-bit counter simulation waveform.

Case statement

Case_statement ::= case expression is
when choice(s)=>
sequence of sequential statements
[when choices(s)=>
sequence of sequential statements**]**
end case;

Case statement

```
package PACK is
   type month_type is (JAN, FEB, MAR,
                 APR, MAY, JUN, JUL, AUG,
                 SEP, OCT, NOV, DEC);
end PACK;

use work.PACK.all;
entity CASESTMT is
   port (
      MONTH    : in  month_type;
      LEAP        : in  boolean;
      DAYS        : out integer);
end CASESTMT;
architecture RTL of CASESTMT is
begin
   p0 : process (LEAP, MONTH)
begin
      case MONTH is
         when FEB =>
            if LEAP then
               DAYS <= 29;
            else
               DAYS <= 28;
            end if;
         when APR | JUN | SEP | NOV =>
            DAYS <= 30;
         when JUL to AUG =>
            DAYS <= 31;
         when others =>
            DAYS <= 31;
      end case;
   end process;
end RTL;
```

Case statement

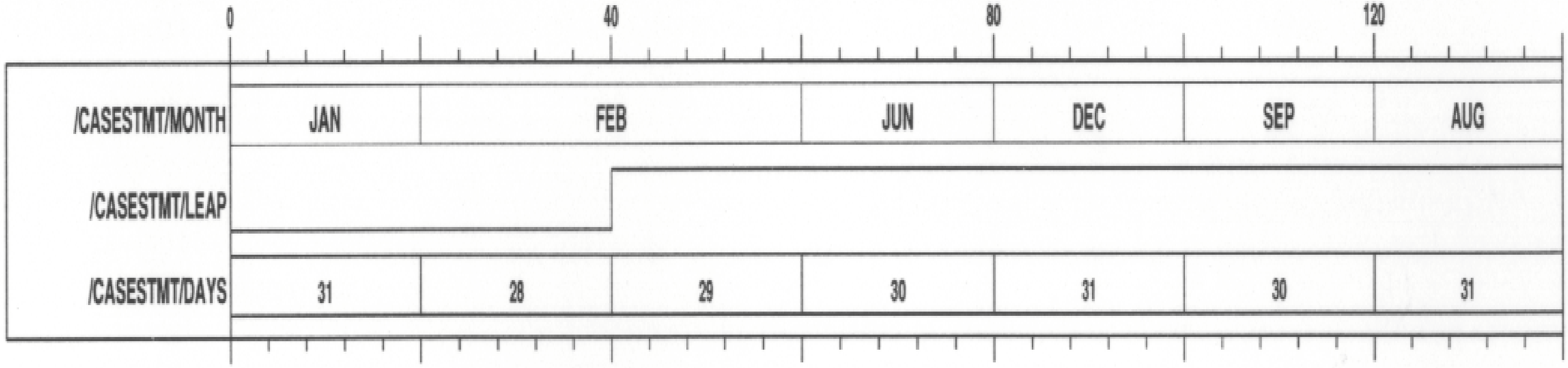


FIGURE 4.7 CASESTMT simulation waveform.

Loop statement

Loop_statement ::=

[loop_label**:][while** condition|**for** identifier **in** discrete_range**]** **loop**

sequence of sequential statements

end loop [loop_label];

Loop statement

```
entity LOOPSTMT is
end LOOPSTMT;
architecture RTL of LOOPSTMT is
  type arytype is array (0 to 9) of
integer;
  signal A : arytype := (1, 2, 3, 4, 11,
                   6, 7, 23, 9, 10);
  signal TOTAL : integer := 0;
begin
  p0 : process (A)
    variable sum : integer := 0;
    variable i   : integer := 20;
  begin
    sum := 0;
    loop1 : for i in 0 to 9 loop
     -- notice that i is local in loop1
      exit loop1 when A(i) > 20;
      next when A(i) > 10;
      sum := sum + A(i);
    end loop loop1;
    if i = 20 then
      TOTAL <= -33;
    else
      TOTAL <= sum;
    end if;
  end process;
end RTL;
```

Loop statement

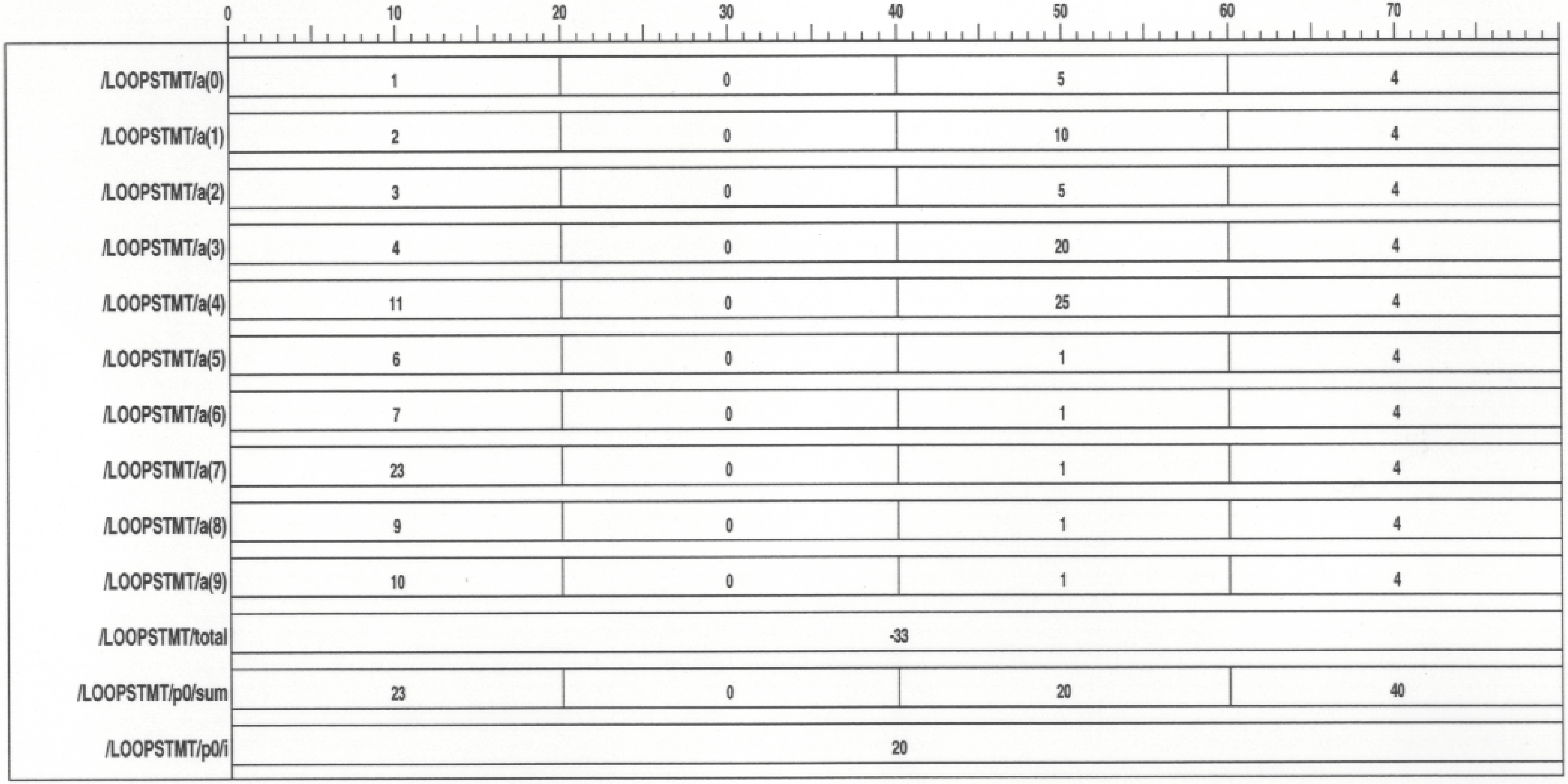


FIGURE 4.8 Simulation waveform for the LOOPSTMT.

Loop statement

```
begin
    sum := 0;
    loop1 : for i in 0 to 9 loop
      exit loop1 when A(i) > 20;
      next when A(i) > 10;
      sum := sum + A(i);
    end loop loop1;
    if i = 20 then
      TOTAL <= -33;
    else
      TOTAL <= sum;
    end if;
  end process;
```

Note:

The looping identifier i is not visible outside the loop statement, and the local variable **i** is not the same as the looping identifier.

Variable **i** is used to assign the signal TOTAL.

Next statement

- **Next_statement** ::= **next** [loop_label][**when** condition];

- Must be enclosed by a loop statement with the same loop label, and the next statement applies to that loop statement.

- If the loop label is not specified, it always applies to the innermost level of the loop statements.

Exit statement

Exit_statement ::= **exit** [loop_label][**when** condition];

- Must be enclosed by a loop statement with the same loop label, and the exit applies to that loop statement.
- If the loop label is not specified, the exit always applies to the innermost level of the loop statements.

Exit statement

```
entity EXITSTMT is
end EXITSTMT;
architecture BEH of EXITSTMT is
  type matrix is array (1 to 5, 1 to 4) of
integer;
   constant TABLE : matrix :=
                  ( (1, 2, 3, 4),
                   (2, 8, 1, 0),
                   (8, 5, 3, 7),
                   (3, 0, 2, 1),
                   (1, 1, 0, 2) );
begin
  p0 : process
       variable NUMROW, ROWSUM :
           integer := 0;
```

```
  variable ROWDONE, ALLDONE : bit;
begin
  ALLDONE := '0';
  outloop : for i in matrix'range(1)  loop
    ROWSUM  := 0;
    ROWDONE := '0';
    inloop : for j in matrix'range(2) loop
    ROWSUM := ROWSUM + TABLE (i, j);
    if (ROWSUM > 10) then
         NUMROW := NUMROW + 1;
         exit outloop when NUMROW = 2;
         exit; -- get out of inloop
    end if;
    wait for 20 ns;
    end loop inloop;
```

Exit statement

```
            ROWDONE := '1';
            wait for 20 ns;
       end loop outloop;
       ALLDONE := '1';
       wait for 60 ns;
     end process;
  end BEH;
```

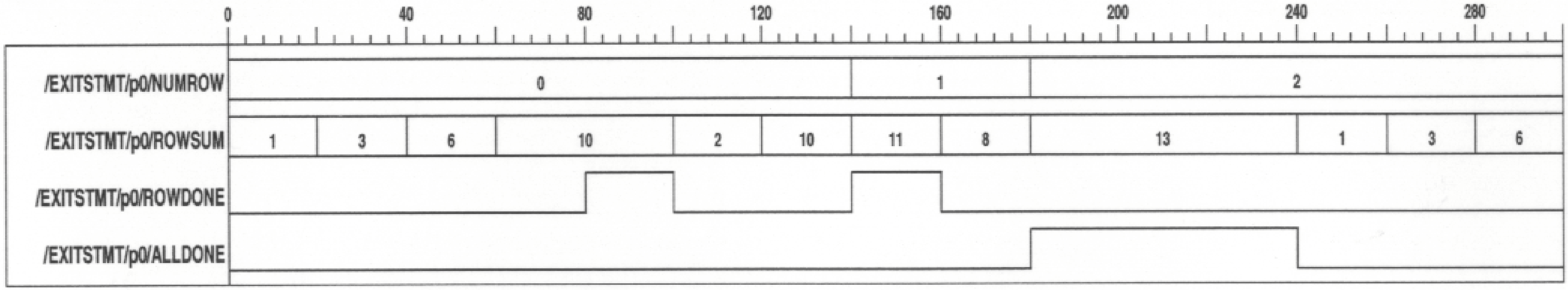


FIGURE 4.9 Simulation waveform for the EXITSTMT VHDL code.