

Assignment-5 (CS 232) by Utkarsh Ranjan

4-bit Booth multiplier

Description

- 4 Inputs :- Two 4-bit string (A,B), 1 clock input (clk), 1 reset input (rst)
- 1 Output :- One 8-bit string (result)
- It returns multiplication of the two integers given as 4-bit string input

Idea

- We multiply A with couplets of B (For eg. multiply A with B_1B_0 and then multiply A with B_3B_2 .) instead of multiplying A with each bit of B individually as done in array multiplier.
- Following are the rules followed while obtaining partial products in the booth's multiplier.
 1. If B_1B_0 is
 - a) "00" then A multiplied by B_1B_0 is 0.
 - b) "01" then A multiplied by B_1B_0 is A.
 - c) "10" then A multiplied by B_1B_0 is 2A i.e. A left shifted by 1 place.
 - d) "11" then A multiplied by B_1B_0 is 3A. So we will be obtaining 3A by performing (4A - A), wherein 4A is A left shifted by 2 places and (-A) is 2's complement of A.
 2. Similarly we need to perform operations depending on the value given by B_3B_2 .
- Two std_logic_vector signals were defined (p1 and p2) to store the value of the products with the couplets.
- On the first clock cycle the output "00000000" was produced while in the second cycle the sum $p1 + p2$ was produced. This sum gives us the multiplication of the input signals which is our final result.
- This implementation of producing output in the second clock cycle is done using two states - 0 and 1;