



UNIVERSITY OF TEHRAN
Electrical and Computer Engineering Department
Digital Logic Design ECE 367 / Digital System I ECE 894
Fall 1399
Computer Assignment 6
RTL Complete Component Design - Week 16

Name:	Date:
Username:	

You are to design an accelerator for calculation of $\cos(x)$, where x is between 0 and $\pi/2$. Calculation is to be done by Taylor series expansion of $\cos(x)$. The input x is a 10-bit fixed point number with 8 fractional and 2 integer bits. The output is also a 10-bit fixed point number, the integer part of which is always 0. In addition to the x input, the circuit has an 8-bit fixed point y input that defines the precision of the calculation of $\cos(x)$. The iteration of Taylor series calculations stops if a term being added is less than y . Complete the RTL design of this accelerator. Perform simulation and synthesis of this circuit.

$$\cos x = \sum_{n=0}^{\infty} \frac{(-1)^n}{(2n)!} x^{2n} = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \dots \quad \text{for all } x$$

Design Phase:

1. Show the schematic diagram of the datapath of this circuit.
2. Show the controller state diagram.
3. Implement the datapath (on paper) using components discussed in class. Use a lookup-table ROM for coefficients.
4. Write Controller Verilog description and show its Hoffman model.
5. Show how the controller Hoffman model connects to the datapath and outside busses.

Implementation Phase:

1. Build the $\cos(x)$ computation unit in Quartus II using predefined Altera components, Verilog modules, and discrete parts. Use a memory hex file for initializing your ROM.
2. Enter the Verilog description of the controller of $\cos(x)$ in Quartus II.
3. Generate the complete design of $\cos(x)$.
4. Synthesize the complete circuit and generate its .vo and .sdo files.
5. In a testbench, test your complete circuit.