



Experiment No. # 5

Linear convolution using ZYBO Evaluation Board

1) Objectives:

- a) Linear Convolution of two sequences on ZYBO (FPGA) Evaluation Board.

2) Software used:

- a) Vivado.

A. Pre-Lab

- a) Read basic VHDL or verilog coding.
- b) Read specification sheet or pin diagram of ZYBO board.
- c) Perform Half-Adder and Clock divider on the vivado software prior to the lab.

I. LINEAR CONVOLUTION USING ZYBO EVALUATION BOARD

A. Theory:

- 1) "Introduction to VHDL", J.Bhaskar.

B. Procedure:

- 1) Linear Convolution: On ZYBO board, As a first step to visualize the convolution we have following things available,
 - 4 Pushbutton switches
 - 4 DIP switches
 - 4 LEDs
 - Internal clock of (450 MHz), so multiply with a very high integer value approx. '5000000', to make the LED visually stable for second.
- 2) Open Vivado software.
- 3) Follow all the basic steps to create a linearconvol.pjt project.
- 4) Create/Add a VHDL RTL linearconvol.vhd file with A and B as inputs and C as output having 4 digits (3 down to 0).
- 5) Create a constraint file, in which copy the standard ZYBO pin constraint file available on Internet or shared with you.
- 6) Uncomment the DIP switches, pushbutton switches and LEDs required and map to the variables created in the vhd source file.
- 7) Follow all the steps to perform analysis and synthesize the above project (Simply follow all the next next steps in vivado till the synthesis is done successfully).
- 8) Utilize vivado system simulator to simulate the linear convolution.
- 9) Again follow the internal steps of vivado to generate bit stream.
- 10) Open Hardware manager, add the zybo board available and change the system clock to minimum value.
- 11) Program the device using generated bit stream.

C. Observation:

- 1) Perform an LED ON and OFF using DIP switch.
- 2) Perform an LED ON-OFF using Pushbutton switch.
- 3) Change the LED ON-OFF speed by controlling the internal clock.
- 4) Verify linear convolution in simulator.
- 5) Verify linear convolution of two sequences having 4 bit length on LEDs using DIP and push-button switches.

D. Conclusion:

Conclude the experiment.

Well Done
