Pontificia Universidad Católica de Chile
Escuela de Ingeniería
Departamento de Ingeniería Eléctrica
IEE2463 Sistema electrónicos programables

Laboratory 08

ZYBO-Z7 Microblaze Debugging a C Code

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1. Laboratory Goals

The goals of this laboratory are:

- To initialize Debug mode of Microblaze.
- To understand the debug environment in Vitis.
- To debug a self designed program written in C Code.

2. Previous Requirements

These requirements are mandatory to perform the laboratory. Not accomplishing them count as missing the laboratory.

- You must have previously installed vitis/vivado version 2020.1.
- You must read the ZYbo Z7 Board Reference.
- You must understand the design flow between vitis and vivado to program a microprocessor.

Note: **Version of the software 2020.1 is mandatory**. This is important to avoid compatibility problems.

3. Laboratory Activities

- Based on LAB07, create a new folder project as LAB08.
- Introduce the Zynq Module in vivado , so the debug mode for microblaze can be enabled.
- Create a Vitis project associated to this new hardware.
- Write a C program that perform the task described below.
- Debug the program, check the memory size and memory address of different variables. Add relevant expressions to check their change throughput the code.

C Program

Imagine you have a secrete number within your code. This number is a 4bits number that reveals the secret of the universe. The number is saved in a specific memory address (which you can access through a pointer). The ZYbo Z7 will show you this number with its 4 LEDs, but for obtain the number you nee to enter your secret password, composed of a specific position of the switches followed by a combination of buttons.
Example: key can be SW0-ON; SW1-OFF; SW2-ON; SW3-OFF. + pressing BTN0 and then BTN2;

The system will acknowledge your entrance, and if the password is wrong, it will a specific LED combination five times, Indicating that your entrance is wrong.

If your entrance is correct, then the LEDS1 LEDS2 and LED3 will turn on individually, forming a sequence of 8 digits. Example: LED1-ON; LED2-ON; LED0-ON; LED1-ON;LED1-ON; LED2-ON;LED1-ON;LED1-ON;. Obviously after each LED turns on, you must turn-OFF all LEDs, so you can see only one LED turned ON at a time. The time the LED remains ON is at your choice.

Now you can use the three available buttons to replicate the combination given by the ZYBO through the LEDs, once the microblaze receive this buttons combination, the secret code will be revealed at the 4 LEDs.

- Define a structure which contains all combinations of Switches, and one LED combination that will blink 5 times (in case of wrong entrance).
- Make use of pointer to access the data at your choice.
- Create one function that checks the correct introduction of the first code and a second function that cjecks the introduction of the second code.
- Localize the 4bits number that reveals the secret of the universe using a pointer.

4. Complementary Homework

To fulfill this homework is mandatory, but not evaluated.

- Associate a button to start the game. Before pressing that button the Zybo will no receive any code. Make his using interrupts.
- To reveal a most sophisticated code, modify your hardware and introduce the RGB LEDS. Each RGB LED in connected to a PWM IP-Core (created by you). From microblaze you send a number that represents the duty cycle of the PWM module. Thereby, when you reveal the final code, it is a 4bits number plus a specific color in the RGB button.