**System Design Flow on Zynq using Vivado Workshop**

**ZYBO**

**COURSE DESCRIPTION**

This course provides professors necessary skills to design and debug a system using Vivado IP Integrator, hardware analyzer, and Vivado HLS.

# Install Xilinx software

Professors may submit the online donation request form at <http://www.xilinx.com/member/xup/donation/request.htm> to obtain the latest Xilinx software. The workshop was tested on a PC running Microsoft Windows 7 professional edition.

* Vivado 2015.2 System Edition

1. **Setup hardware**

Connect ZYBO

* 1. Set the power supply jumper to USB so the board can be powered up and laboratory assignments can be carried out using single micro-usb cable
  2. Connect a micro USB cable between PROG UART port of ZYBO and PC

1. **Install distribution**

Extract the **2015\_2\_zynq\_zybo\_sources.zip** file in the *c:\xup\sys\_design* directory. This will create a **2015\_2\_zynq\_sources** folder. Create the **c:\xup\sys\_design\2015\_2\_zynq\_labs** directory. This is where you will do the labs. The **2015\_2\_zynq\_labdocs\_pdf.zip** file consists of lab documents in the PDF format. Extract this zip file in c:\xup\sys\_design directory or any other directory of your choice.

Download the zybo.zip file and extract it in the **<Vivado\_2015\_2\_install\_dir>\Vivado\2015.2\data\boards\board\_files\zynq.** This directory is the board files directory and having it in the specified directory will allow you to select Zybo board during the design creation.

1. **For Professors only**

Download the **2015\_2\_zybo\_labsolution.zip** and **2015\_2\_zynq\_docs\_source.zip** files using your membership account. Do not distribute them to students or post them on a web site. The **2015\_2\_zynq\_docs\_source.zip** file contains lab documents in Microsoft Word and presentations in PowerPoint format for you to use in your classroom.

1. **Get Started**

Review the presentation slides (see course agenda) and step through the lab exercises (see lab descriptions) to complete the labs.

# COURSE AGENDA

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| **Day 1 Agenda** | **Day 1 Materials** |
| Class Intro | 01\_class\_intro.pptx | |
| 7 Series Architecture Overview | 11\_7\_Series\_Architecture\_Overview.ppt x | |
| Vivado Design Flow | 12\_Vivado Design\_Flow.pptx | |
| Lab 1: Synthesizing a RTL Design | 11a\_lab1\_intro.pptx  Lab01.docx | |
| Xilinx Design Constraints | 13\_Xilinx\_Design\_Constraints.pptx | |
| Lab 2: Xilinx Design Constraints | 13a\_lab2\_intro.pptx  Lab02.docx | |
| IP Integrator and Embedded System Design Flow | 14\_IPI\_And\_Embedded\_System\_Design.pptx | |
| Lab 3: Create a Processor System using IP Integrator | 14a\_lab3\_intro.pptx  Lab03.docx | |
| **Day 2 Agenda** | **Day 2 Materials** | |
| Creating and Adding Custom IP | 21\_Creating\_and\_Adding\_Custom\_IP.pptx | |
| Lab 4: Creating and Adding Custom IP in PL | 21a\_lab4\_intro.pptx  Lab04.docx | |
| System Debugging | 22\_System\_Debugging.pptx | |
| Lab 5: System Debugging using Vivado Logic Analyzer and SDK | 22a\_lab5\_into.pptx  Lab05.docx | |
| Profiling and Performance Improvement | 23\_Profiling\_and\_Performance\_Improvement.pptx | |
| Introduction to High-Level Synthesis with Vivado HLS | 24\_Vivado\_HLS\_Intro.pptx | |
| Improving Performance and Resource Utilization | 25\_Improving\_Performance\_and\_Resource\_Utilization | |
| Creating an Accelerator | 26\_Creating\_an\_accelerator.pptx | |
| Lab 6: Creating a Processor System | 26a\_lab6\_into.pptx  Lab06.docx | |

**LAB** **DESCRIPTIONS**

Lab 1 - Use Vivado IDE to create a simple HDL design. Simulate the design using the XSim HDL simulator available in Vivado design suite. Generate the bitstream and verify in hardware.

Lab 2 - Create a project with I/O Planning type, enter pin locations, and export it to the RTL. Then create the timing constraints and perform the timing analysis.

Lab 3 – Create a simple ARM Cortex-A9 based processor design targeting the ZedBoard using IP Integrator.

Lab 4 - Use the Manage IP feature of Vivado to create a custom IP and extend the system with the custom peripheral. Write a basic C application to access the peripherals.

Lab 5 - Insert various Vivado Logic Analyzer cores to perform cross-triggering and debug/analyze system behavior.

Lab 6 - Profile an application performing a function both in software and hardware. Create an accelerator in Vivado HLS. Use the generated accelerator to build a complete system.

1. **Contact XUP**

Send an email to [xup@xilinx.com](mailto:xup@xilinx.com) for questions or comments