FAQ for *FPGA Prototyping by VHDL Examples*

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If your question is not answered, please e-mail me at p.chu@csuohio.edu and I'll try to incorporate them into FAQ in future update

General

Q. What is this book for?
A. The focus of the book is on FPGA and VHDL synthesis and on how to develop VHDL code that accurately and effectively describes the desired hardware. The book uses a "learning-by-doing" approach and illustrates the design and development process by a series of hands-on experiments and projects.

Q. What is this book **not** for?
A. The book is not intended to provide comprehensive coverage of the following:

- VHDL. VHDL is complex language. The book only uses and discusses a small, synthesizable subset of VHDL.
- Xilinx software/device. The book includes a general overview of FPGA and several tutorials of Xilinx software, just providing enough information for the experiments and projects. Detailed information can be found in Xilinx data sheets and manuals.
- Testbench. The book includes two simple testbench templates, which can be used for simple combinational and sequential circuits, and dose not provide detailed discussion on testbench. Many testing circuits are included to physically verify the module's operation.
- MicroBlaze. The book does not cover the MicroBlaze soft-core processor.

Q. Does the book cover any soft-core processor?
A. Xilinx provides two soft-core processor cores: a simple 8-bit PicoBlaze and a sophisticated 32-bit MicroBlaze. The PicoBlaze processor is like a simple microcontroller. Four chapters in the book cover development flow, assembly code, I/O interface, and software/hardware integration of PicoBlaze.

Q. Why MicroBlaze is not covered?
A. MicroBlaze is a full-blown 32-bit RISC processor. Using MicroBlaze introduces a new (and complex) chain of software tools and needs additional technical knowledge, including computer architecture, embedded system development, real-time operating system and networking. Meaningful coverage of MicroBlaze will require another book.

Q. What is the difference between the book *FPGA Prototyping by VHDL Examples* and the book *RTL Hardware Design Using VHDL*?
A. The latter book is more general and covers more "fundamental" design issues such as resource sharing, scalable design and synchronization. The former is more "practical" and mainly focuses on the design and development of peripherals on the prototyping board.

Q. What is the difference between the book *FPGA Prototyping by VHDL Examples* and the book *FPGA Prototyping by Verilog Examples*?
A. The two books cover the same experiments and examples. One is using the VHDL language and the other is using the Verilog language.

Prototyping Board

Q. Which prototyping boards can be used?

A. The book is intended to be used with inexpensive, introductory FPGA prototyping boards. The codes are developed for the Diglent/Xilinx *Spartan-3 Starter Board*. Several other boards, including the Digilent *Basys Board*, Digilent *Nexys-2 Board* and Altera *DE1/DE2 Boards*, can also be used with minimal modification. Most boards cost less than US$100. If the *Spartan-3 Starter Board* is used, the codes and constraint file can be downloaded from the book's companion Website and used directly.

Q. Why the *Spartan-3 Starter Board* is chosen?

A. I started this book project a few years ago. The *Spartan-3 Starter Board* was the state-of-the-art board at that time. Although a little aged now, it is still a good, useful board.

Q. Why Xililx is chosen?

A. At the time I started the book, there was not an adequate low-cost Altera board (Altera University Program currently provides the *DE1/DE2 Boards* and they are very good).

Q. How about the Digilent *Nexys-2 Board*?

A. The *Nexys-2 Board* is a newer board. It is similar to the *Spartan-3 Starter Board* but with a larger FPGA device and a larger memory chip. Following modifications are needed:

- The color depth of the *Nexys-2 Board* is increased from 3 bits to 8 bits. The output of the VGA interface circuits discussed in Chapters 12 and 13 needs to be modified accordingly.
- The *Nexys-2 Board* contains a more sophisticated memory chip. Although it can be configured as an SRAM, its timing characteristics are different and thus the memory controller in Chapter 10 can no longer be used. The same design principle can be used to construct a new controller.
- A new constraint file must be created for the new assignment.
- The *Nexys-2 Board* uses Digilent Adept Suite to download the configuration file to the FPGA chip.

Q. How about the Digilent *Basys Board*?

A. The Digilent *Basys Board* is a simpler board. It lacks the RS232 port and contains no external memory. Following modifications are needed:

- Experiments involved UART and serial interface, including the module in Chapter 7 and several experiments in subsequent chapters, cannot be implemented. One way to overcome this problem is to purchase the Digilent's *RS232 Converter Peripheral Module*.
- Memory controller cannot be constructed.
- A new constraint file must be created for the pin assignment.
- The *Basys Board* uses Digilent Adept Suite to download the configuration file to the FPGA chip.

Q. How about the Altera *DE1/DE2 Boards*?

A. The Altera *DE1/DE2 Boards* are two educational boards from Altera. The *DE1/DE2 Boards* and *Spartan-3 Starter Board* share many similar peripherals and thus the codes can also be used for the *DE1/DE2 Boards*. The main differences are:

- Altera software is needed to synthesize and program the Altera FPGA chip.
- The *DE1/DE2 Boards* do not use time-multiplexing for the seven-segment LED display and thus only decoders are needed.
- The PicoBlaze processor cannot be synthesized.

Q. How about other FPGA prototyping boards?

A. Most peripherals discussed in this book are de facto industrial standards, and the corresponding HDL codes can be used as long as a board provides proper analog interface circuits and connectors. Most peripheral modules in the book consist of the module itself and a testing circuit that observes and verifies the operation of the module. The testing circuit usually uses the seven-segment LED display on the *Spartan-3 Starter Board* to show the status of operation. Many advanced FPGA boards use an LCD display instead, and thus these testing circuit must be modified accordingly.

Q. Are the codes portable?

A. One major goal of the book is to help readers to develop codes that are device-independent and software-neutral. The device-dependent features or components are deliberately avoided. The codes are portable in general except for the PicoBlaze processor. The source code of PicoBlaze uses low-level Xilinx primitives and thus can only be targeted to Xilinx device.