



Impulse Ready-to-Run Example

Accelerating a Complex FIR Filter on an Avnet Virtex-5 FXT Board

Impulse Accelerated Technologies, Inc.

www.ImpulseC.com

Overview

This ready-to-run example demonstrates how to use Impulse C to create an accelerated DSP application using an Avnet Virtex-5 FXT Evaluation Kit, the Xilinx EDK tools and the embedded MicroBlaze processor. The methods used in this example can be applied to many similar embedded MicroBlaze DSP applications.

This example assumes some knowledge of the Xilinx EDK tools. For a detailed description of how to use Impulse C with the Xilinx EDK tools and the MicroBlaze processor, please see the tutorials installed with your Impulse CoDeveloper tools.

See also the following Xilinx application note:

http://www.xilinx.com/support/documentation/application_notes/xapp901.pdf

Example Notes

Impulse C can be used to generate hardware modules that are directly connected to an embedded processor (such as the Xilinx MicroBlaze) or to other hardware elements that may have been described using other design tools or techniques. The Impulse C programming model emphasizes the use of data streams, signals, and shared memories for process-to-process communication. These interfaces can be used to connect Impulse C processes to a wide variety of hardware devices and processors.

For the MicroBlaze embedded processor, there are multiple possible ways to provide communication between a software application running on the processor, and a hardware accelerator running in the FPGA fabric. These include (among others):

- Using the PLB to create an Impulse C peripheral on a shared bus
- Using the FSL interface to create a high-speed data stream
- Using shared memory

This example demonstrates a streaming application using the FSL.

In this example, a software application running on the MicroBlaze communicates with the hardware FIR filter using Impulse C FSL functions/macros, which are implemented by the Impulse C compiler using the FSL.

Project Files and EDK Settings

ZIP File Directory Structure

Avnet_fxt_MB_ComplexFIR.PDF	(This document)
fxtPComplexFIR_edk10_1_02/	(Impulse C project source files)
fxtPComplexFIR_edk10_1_02/EDK_MB	(EDK project)
fxtPComplexFIR_edk10_1_02/ReadyToRun	(download.bit and executable.elf)

Hardware Platform

Avnet Virtex-5 FXT Evaluation Kit

Software Versions

Impulse CoDeveloper Version 3.20
 Xilinx ISE Version 10.1 SP2
 Xilinx EDK Version 10.1 SP2

Impulse C Platform Support Package

Xilinx Virtex-5 FSL

Xilinx EDK Settings

Board name: Avnet Virtex-5 FXT
 Processor: MicroBlaze
 Reference clock frequency: 100 MHz
 Processor clock frequency: 125 MHz
 System bus clock frequency: 125 MHz
 Local memory (BRAM): 32 KB
 IO Devices:
 RS232_Uart 19200 8-N-1
 LEDs_8bit
 DDR2_SDRAM
 Peripherals:
 XPS TIMER 32 bit one timer
 STDIN: RS232_uart
 STDOUT: RS232_Uart
 Boot Memory: ilmb_cntlr

Two FSLs (Fast Simplex Link) are needed for connecting the Impulse FSL module to the MicroBlaze. In MicroBlaze properties, change the number of FSL links to two (2).

A clock output with a frequency of 62,500,000 Hz is needed to be added to the clock generator for the Impulse module's co_clk.

Downloading the Bitmap

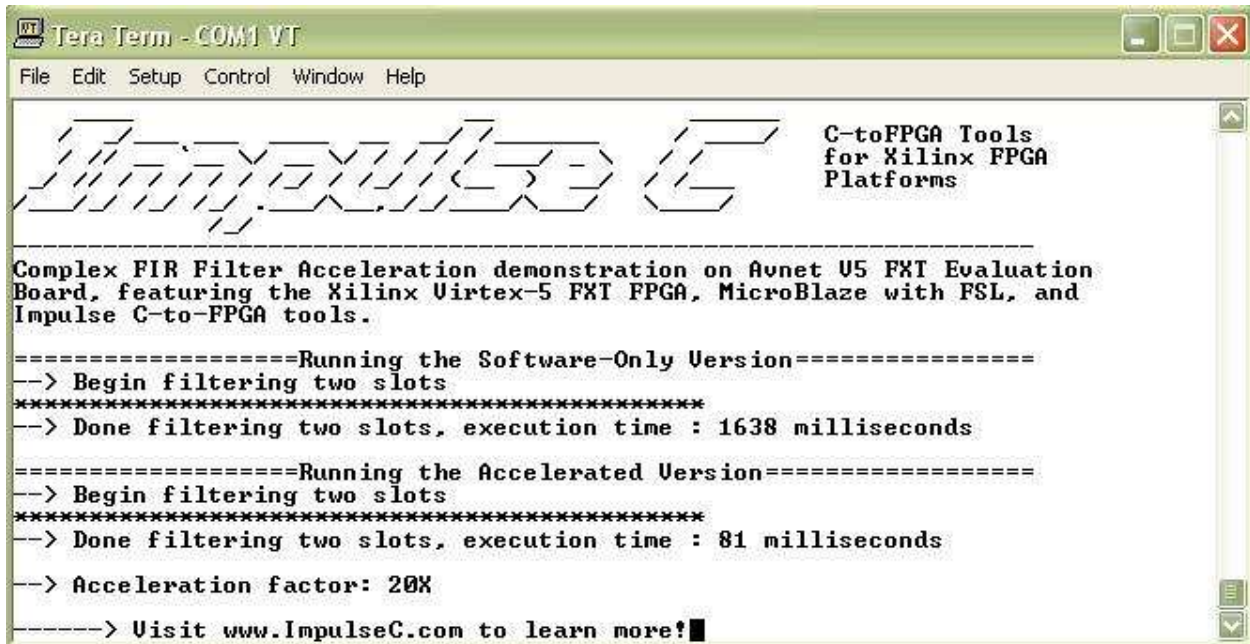
The *download.bit* file can be downloaded to the FPGA using iMPACT.

XMD Commands for Execution

```
dow fil/executable.elf
con
```

Result Display

Open a HyperTerminal or TeraTerm window, and set the serial port to baud rate 19200, 8-N-1. The output will be as shown below:



The screenshot shows a TeraTerm window titled "Tera Term - COM1 VT". The window contains the following text:

```
Impulse C-toFPGA Tools for Xilinx FPGA Platforms

Complex FIR Filter Acceleration demonstration on Avnet U5 FXT Evaluation
Board, featuring the Xilinx Virtex-5 FXT FPGA, MicroBlaze with FSL, and
Impulse C-to-FPGA tools.

=====Running the Software-Only Version=====
--> Begin filtering two slots
*****
--> Done filtering two slots, execution time : 1638 milliseconds

=====Running the Accelerated Version=====
--> Begin filtering two slots
*****
--> Done filtering two slots, execution time : 81 milliseconds

--> Acceleration factor: 20X

-----> Visit www.ImpulseC.com to learn more!
```