ML506 DSP Hardware Co-Simulation with Xilinx System Generator for DSP

July 2010
Overview

- ML506 Board
- Setup
  - Software Requirements
  - Network Setup
  - Hardware Setup
  - CompactFlash Setup
- System Generator Hardware Co-Simulation
- References

Note: This presentation applies to the ML506
ISE Software Requirements

- Xilinx ISE 12.1 software

Note: Presentation applies to the ML505, ML506, and ML507
System Generator Software Requirement

- Xilinx System Generator 12.1

*Note:* Presentation applies to the ML506
Matlab Software Requirement

- Matlab is a third party software, available from MathWorks
  - Matlab R2009b
WinPcap Software Requirement

- As stated in the System Generator User’s Guide, pg. 280, WinPcap is required for Co-simulation
  - www.winpcap.org Version 4.0 or higher

Note: Presentation applies to the ML506
ML506 Setup

- **Set ML506 Jumpers for GMII**
  - Set both J22 and J23 to positions 1-2 (as shown)

*Note: Presentation applies to the ML506*
Network Setup

- A Gigabit Ethernet Adapter on your PC is required
- From the Windows Control Panel
  - Open Network Connections
  - Right-click on the Gigabit Ethernet Adapter
  - Select Properties

Note: Presentation applies to the ML506
Network Setup

- **Click Configure**
  - Set the Media Type to Auto for 1 Gbps then click OK

*Note: Presentation applies to the ML506*
Network Setup

- Reopen the properties after the last step
- Set your host (PC) to an IP Address of 192.168.8.2:

Note: Presentation applies to the ML506
Network Setup

- Connect an Ethernet cable from the ML506 to the Gigabit Ethernet Adapter

Note: Presentation applies to the ML506
Software Setup

- From Windows, select Start → All Programs → Xilinx ISE Design Suite 12.1 → System Generator → System Generator MATLAB Configurator
- Select Matlab version R2009b
Software Setup

- From Windows, select Start → All Programs → Xilinx ISE Design Suite 12.1 → System Generator → System Generator

Note: Presentation applies to the ML506
Hardware Setup

- Use a CompactFlash reader to mount a CompactFlash as a disk drive
- Delete all files in this CompactFlash

Note: Presentation applies to the ML506
Hardware Setup

- Type this command to update the CompactFlash:
  `unzip(fullfile(xilinxSysgenRoot,'plugins/bin/ML506_sysace_cf.zip'), '<CF Drive Letter>:\')`

**Note:** Ignore the warning message
Hardware Setup

- These files should appear on your CompactFlash
- Eject the CompactFlash from your PC
Additional Setup Details

- Refer to ml505_overview_setup.ppt for details on:
  - Software Requirements
  - ML506 Board Setup
  - Equipment and Cables
  - Software
  - Network

- Terminal Programs
  - This presentation requires the 9600-8-N-1 Baud terminal setup
Using the Pre-Built Design

- Unzip `dsp48macro_macfir.zip` to `C:\`
- Open the model
  - Launch Xilinx System Generator
  - Set MATLAB to point to the `C:\dsp48macro_macfir` directory
  - Double-click on the `dsp48macro_macfir.mdl`, located in the “Current Directory” Tab in MATLAB
  - Go to Slide 42, to run the simulation
- For a tutorial on how to create the contents of the `dsp48macro_macfir.zip`, continue to the next slide

**Note:** Presentation applies to the ML506
Open DSP Example

- From Matlab R2009b, select Help → Demos (1)

Note: Presentation applies to the ML506
Open DSP Example

- Select Blocksets → Xilinx → More demos and Examples → Local Examples and click on the User’s Guide link

**Note:** Presentation applies to the ML506
Open DSP Example

- Scroll down to the DSP section and select the FIR filter using the DSP48 Macro block and click on “Open this model” (1)

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DSP48 Macro

- Model appears as seen below
DSP48 Macro

- Create a directory: C:\dsp48macro_macfir\ 
  - Save the Model to this location 
  - Set the current directory in MATLAB to C:\dsp48macro_macfir

Note: Presentation applies to the ML506
Move the input

- Click once on the net marked "Input" and press the delete key

Note: Presentation applies to the ML506
Move the input

- The net from the Sine wave to the adder input should still be connected

Note: Presentation applies to the ML506
Move the input

- Drag a connection from the scope (1) to the net after the adder (2)

Note: Presentation applies to the ML506
Move the input

- Double click this new net and name it "Input_with_Noise" (1)

Note: Presentation applies to the ML506
Generate Block

- Double-click the System Generator Block

Note: Presentation applies to the ML506
Generate Block

- Select Compilation: Hardware Co-simulation > ML506 > Ethernet > Point-to-point
Generate Block

- Click Generate

Note: Presentation applies to the ML506
Generated DSP48 Block

- After compilation, a new window with the generated DSP Hardware block appears
  - Note: The order of the output pins varies from the top to bottom order in the model; pay attention to this when making connections

Note: Presentation applies to the ML506
Add DSP48 Block

- Drag block from library window to original dsp48 window

Note: Presentation applies to the ML506
Add DSP48 Block

- Click on the Simulink button in Matlab

Note: Presentation applies to the ML506
Add DSP48 Block

- In the Simulink Library Browser under Simulink → Discrete, select the Discrete Filter

Note: Presentation applies to the ML506
Add DSP48 Block

- Right click on the Discrete filter and add it to the \texttt{dsp48macro\_macfir}
- Also add an Integer Delay

\textbf{Note:} Presentation applies to the ML506
Add DSP48 Block

- Select Commonly Used Blocks
- Add two Sum blocks

Note: Presentation applies to the ML506
Add DSP48 Block

- Add a Scope block

Note: Presentation applies to the ML506
Configure Scope

- Double-click on Scope1, click the parameters button (1) and set the number of Axes to 6 (2)

Note: Presentation applies to the ML506
Configure Scope

- Double-click on Discrete Filter1
  - Set the numerator coefficient to \texttt{fir1(15,0.5)}
  - Set the Denominator coefficient to \texttt{1}

Note: Presentation applies to the ML506
Configure Scope

- Double-click on Sum3 and Sum4 blocks
  - Set the list of signs to |+-|

Note: Presentation applies to the ML506
Connect as Shown

Note: Presentation applies to the ML506
Run Hardware Co-simulation

- Double click on the dsp48macro_macfir hwcosim block

Note: Presentation applies to the ML506
Run Hardware Co-simulation

- Under the Ethernet tab, select the desired Ethernet Connection

Note: Presentation applies to the ML506
Run Hardware Co-simulation

- Under the Configuration tab, select Point-to-point Ethernet
  - Click OK

Note: Presentation applies to the ML506
Output Waveforms

- Right Click on Scope and select Open Block
- Repeat for Scope1
- Both should show no waveforms
- Click Dock Scope (small down arrow) on both (1)

Note: Presentation applies to the ML506
Output Waveforms

- In the Matlab window, click Undock Figures (small up arrow) (1)

Note: Presentation applies to the ML506
Output Waveforms

- Figures Window set to side-by-side display
Simulate the FIR Filter

- Select Simulation → Start (1)
Simulate the FIR Filter

- Set Stop time to 200 (1)
Simulate the FIR Filter

- Select Simulation → Start (1)

The modified n-tap MAC FIR Filter block can run at a speed of up to 450MHz. This cannot be met by the n Tap Mac FIR filter block that does not use DSP48

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Output Waveforms

- Click Autoscale for both scopes (1)
- The waveforms should be identical
References
Documentation

- **System Generator**
  - System Generator for DSP
    http://www.xilinx.com/tools/sysgen.htm
  - Xilinx System Generator for DSP Getting Started Guide – UG638
  - Xilinx System Generator for DSP Getting Started Guide – UG639
  - Virtex-5 XtremeDSP Design Considerations User Guide – UG193
Documentation

- **ML505/506/507 Documentation**
  - ML505 Overview
    [http://www.xilinx.com/ml505](http://www.xilinx.com/ml505)
  - ML506 Overview
    [http://www.xilinx.com/ml506](http://www.xilinx.com/ml506)
  - ML507 Overview
  - ML505/506/507 Getting Started Tutorial – UG348