SYNOPSYS®

Predictable Success

Success with the Synopsys® Synplicity® Business Group and Lockheed Martin Space Systems

Synplify® DSP Success Story

"With the Synplify DSP tool we were able to work directly in the Matlab environment and still have a path to simulation and hardware without recoding our algorithms,"

— Brad Watson,
Staff Engineer,
Advanced Algorithm
Development Group,
Lockheed Martin Space Systems

Synplicity®

Simply Better Results

Summary

Lockheed Martin Space Systems, one of four business units of the Lockheed Martin Corporation, is pioneering the development of all-digital designs for satellite components using DSPs. On a recent project in which Lockheed Martin needed to speed up the development of some DSP designs, the company chose the Synplify® DSP product from Synopsys' Synplicity Business Group because it allows developers without RTL know-how to make substantial contributions and because it produces device-independent code. Lockheed Martin estimates that the Synplify DSP tool made it possible to complete the design in one-quarter the time it would otherwise have taken.

Accomplishing All-Digital Solutions Using FPGAs for DSP Operations

Lockheed Martin Corporation has been one of the United States' aerospace giants for decades. Its Space Systems company, a major business unit headquartered near Denver, Colorado, is a world leader in the design, production and integration of launch vehicles, communications satellites, and other space-born systems. Space Systems also works closely with United Space Alliance, which manages and conducts space operations work involving the operation and maintenance of multi-purpose space systems, and is the prime contractor for NASA's Space Shuttle program.

The communications satellites that Space Systems produces employ complex systems called channelizers that perform bandwidth subdivision. Most channelizers used in satellites are analog in nature, but digital channelization promises many benefits. Therefore Lockheed Martin recently launched a Digital Channelization Unit (DCU) project within its Modular Agile Payload (MAP) program to develop and demonstrate an all-digital solution in a robust flight-like configuration. For its DSP operations, the DCU design employs FPGAs of two types: standard Virtex-2 devices from Xilinx and RTAX radiation-hardened devices from Actel.

Speeding Up Development with the Synplify DSP Tool

Staff engineer Brad Watson began the DSP programming for the DCU project by coding its key algorithms in Matlab from The Mathworks. He initially considered implementing all these algorithms in the FPGAs by hand-coding in VHDL, but immediately realized that it would take too long. No other engineers with VHDL experience were available to help, but fortunately another skilled engineer soon became available, Jon Berry, who had expertise in Matlab as well its companion product from The Mathworks, Simulink. Together the two researched rapid prototyping technologies that had the potential to speed up the effort by taking

advantage of Berry's expertise. Lockheed Martin had acquired a number of such tools for other projects, including the Synplify DSP product, and Watson and Berry evaluated each of them for applicability to their needs.

"Since we had two types of target devices, it was very important to choose a product that produces device-independent VHDL - and only Synplify DSP software did," reported Watson. "Furthermore, the Synplify DSP tool is a straightforward plug-in to Simulink which meant that Jon could contribute fully by performing his part of the job in the Simulink environment. Another advantage is that the Synplify DSP product produces robust VHDL code, unlike others that essentially just create a bunch of instantiated cores. The product's highly graphical environment that models the real hardware was another important factor in our decision."

Obtaining Accurate Performance Predictions

Berry created a Simulink model of the Matlab algorithms that Watson had developed and proceeded to replace the Simulink blocks in his simulation with Synplify DSP blocks. Meanwhile Watson worked mostly in VHDL but also helped with Berry's Synplify DSP work. The team performed extensive back-annotation for timing simulation purposes, taking the VHDL code that the Synplify DSP tool produced and running it in a ModelSim environment. For the most part, according to Watson, the results of this simulation correlated well with actual hardware performance.

The Synplify DSP tool was relatively new at the time, which meant that the team had several occasions to call on Synplicity for support. "Our Synplicity people came on site and worked closely with us, showing us new features and making sure we were on the right path," said Watson. "We took the occasion to suggest some product improvements, many of which showed up in subsequent releases."

Finishing in One-Quarter the Time

"The visualization and graphical environment of the tool proved to be very useful, a real time saver," Watson added. "That, plus the fact that the Synplify DSP tool made it possible for Jon to contribute equally to the project, allowed us to complete the design in one-quarter the time it would have taken me to do it all with VHDL hand coding."

The system that incorporates the DCU is now in final test and the team has begun another project in which the Synplify DSP tool might again play a key role.

"With the Synplify DSP tool we were able to work directly in the Matlab environment and still have a path to hardware and simulation without recoding our algorithms," Watson concluded. "That allowed Jon, who knew Matlab well but has no VHDL experience, to step in and contribute to the design effort in an extremely significant way."

To learn more about the Synplify DSP product, visit http://www.synplicity.com/dsp.

SYNOPSYS®
Predictable Success

Synopsys, Inc.
Synplicity Business Group
600 West California Avenue
Sunnyvale, CA 94086 USA
www.synplicity.com

30708SS

Copyright © 2008 Synopsys, Inc. All rights reserved. Specifications subject to change without notice. Synopsys, Synplicity, the Synplicity logo, "Simply Better Results", Synplify, and Synplify Pro are registered trademarks of Synopsys, Inc.
All other names mentioned herein are trademarks or registered trademarks of their respective companies.