High-Performance Communications Using FPGAs

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ABSTRACT:

The explosive growth of the communications industry, particularly in the wireless based area, is placing ever increasing demands on the digital signal processing (DSP) technology that is at the very heart of these systems. As digital technology pushes closer to the antenna, and higher bandwidth efficiencies are demanded, more complex modulation schemes, equalization and error control methods will be employed. Factor in to these technological requirements increased fiscal imperatives, obsolescence considerations, the need to rapidly deploy a product to market in order to be viable, and the research, development and productization of advanced communication systems becomes a complex process. The technology selected for system implementation is crucial to success. There have traditionally been two main choices for the hardware platform: ASICs and software programmable DSPs (SPDSP). Of more recent times a new possibility has become available – *field programmable gate arrays (FPGAs).* These devices are like miniature silicon foundries with extremely short turn-around times. They allow the signal processing engineer to customize a datapath to exactly match the system processing requirements. FPGAs liberate the designer from the preconceptions of the SPDSP or ASIC designer. The algorithmic choices become richer, and with appropriate selection, extremely high-performance and reconfigurable DSP is the result.

By their very nature FPGAs are configurable, functionality is defined by downloading a personalization bit-stream to the device. This unique capability produces two important effects. FPGA platforms can easily track evolving or new standards, and hardware can be shared between applications.

This presentation will provide a brief overview of Xilinx FPGA technology and illustrate how these devices can be used for DSP. Several examples are considered: FIR filters, adaptive filters, FFTs, and a novel sigma-delta modulator based channelizer. Silicon area, timing and power issues will be addressed. Finally, the new *Virtex* FPGA architecture will be described and the system features that are important for high-end DSP will be examined.