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— Klasie Olivier,
Senior Design Engineer,
CSIR



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Synplify® DSP Success Story

Summary

South Africa's Council for Scientific and Industrial Research (CSIR), one of the continent's premier research institutions, has adopted the Synplify® DSP tool from Synplicity for implementing its DSP algorithms in FPGAs. The CSIR found that the Synplify DSP product is unique in that it combines the features that are most important in a FPGA-for-DSP synthesis tool - device independence, ease of use, and substantial optimization functionality - and that it is backed by very strong support and a commitment to continual product improvement from Synplicity.

For the CSIR project, the Synplify DSP tool delivered better performance and area savings compared with other design flows. The project took two weeks using the Synplify DSP product, but would have probably consumed two months without it. In addition, the area-saving features of the Synplify DSP tool made an all-digital solution possible that otherwise would have required thousands of dollars in analog hardware costs - a savings the organization expects to experience on all the systems it develops. From every viewpoint CSIR considered in the evaluation - capability, usefulness, ease of use, support, and pricing - the Synplify DSP tool proved exceptional.

Pioneering the Use of FPGAs for DSP Applications

The CSIR, based in Pretoria, South Africa, is one of the leading scientific and technological research, development and implementation organizations in Africa. Its mission is to apply directed research and innovation in science and technology to improve the quality of life of the country's people.

One of the CSIR's research areas is Radar and Electronic Warfare Systems, where FPGAs have been used for DSP purposes for over a decade. CSIR was quick to commence an evaluation of Synplify DSP when Synplicity released it. “We needed a better solution and we knew first-hand the quality of Synplicity's products because of our long history of success with them,” explained Klasie Olivier, Senior Design Engineer for the CSIR. “We used the Synplify® tool as our netlist synthesizer for over ten years and then switched to Synplify Pro® software because it produced even better results.”

Strong Support Makes It Easy to Get Started

To evaluate the Synplify DSP product, CSIR engineers selected a project which entailed porting an algorithm called Digital Instantaneous Frequency Measurement (DIFM) to an FPGA. DIFM is described in the paper “A digital instantaneous frequency measurement technique using high-speed analogue-to-digital converters and field programmable gate arrays” by Olivier's colleagues P. L. Herselman and J. E. Cilliers, which was published in

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the South African Journal of Science, Vol. 102 No 7/8, p 345-348. DIFM is used on wideband Digital Radio Frequency Memories (DRFM), a field in which the CSIR is a world-class source of DRFM based solutions. All-digital SoC's incorporating the DIFM algorithm save thousands of dollars compared with the analog alternatives employed previously in DRFM.

Synplicity supported the CSIR closely in installing the Synplify DSP tool and preparing users for the evaluation. "Synplicity's people provided outstanding support, just as they have all along, both locally and from the UK and the U.S.," said Olivier. "When one starts to use new advanced software it is almost never easy, but with the Synplify DSP product it was different. That's because the support is top notch."

Substantial Improvements in Performance, Area, and Development Time

CSIR engineers used Simulink and MATLAB from The Mathworks as the simulation environment for development and verification of the algorithm, and greatly appreciated the fact that the Synplify DSP approach allowed them to refine and optimize the implementation in a completely vendor-independent manner. "With Synplify DSP software we get device and vendor independence and architectural RTL optimizations at the same time," said Olivier. "We are yet to encounter another tool with equivalent capability."

The CSIR found the Synplicity product's "folding" technique extremely valuable in fitting the algorithm into the limited space available for it in the FPGA. "Synplicity's developers employed some very clever techniques for identifying scarce resources and figuring out where they can be reused to conserve on space," Olivier commented.

The results of the evaluation showed the Synplify DSP tool to be exceptional in every respect. It generated results that performed faster while taking up less area, which in turn allowed the design to fit into the all-digital SoC - saving appreciable hardware and integration costs. The tool also saves significant development time, as Olivier explained: "In the ten years we've been porting algorithms to FPGAs

for real-time signal processing, we've gained enough experience to realize how much the Synplify DSP tool can shorten the development cycle. This algorithm took two weeks to port using the Synplify DSP solution, and it would probably have taken two months without it. That's because the algorithm developer, who didn't know Verilog or VHDL, would have had to work with a hardware person who didn't know the algorithm, and all the handoffs between them would have taken considerable time and probably would have impacted the quality of results as well. With the Synplify DSP approach, the algorithm developer is in total control."

Because the evaluation was so successful, the Radar and Electronic Warfare Systems group of CSIR quickly made Synplify DSP software its mainstay for FPGA-for-DSP applications. The organization plans to use it on many projects including a next generation Radar Signal Processor in which the tool's area minimization capability will prove vital. Currently one of the algorithms spans over 12 FPGAs and with the use of the Synplify DSP tool, the CSIR will try to get it integrated within a single FPGA. Also in the plan is an advanced digital receiver for persistent maritime wide area surveillance applications, running an FPGA based algorithm for detecting small targets in sea clutter.

The Company Behind the Product

The CSIR finds Synplicity to be not just a supplier of excellent products, but an excellent business partner in many other ways. "We like the fact that Synplicity people share their product roadmap with us, and work with us to understand our requirements in detail and make sure to take them into account in their plans," Olivier explained. "We also like Synplicity's pricing policies for Synplify DSP software. We've also found with Synplicity the full library is available up front."

"Synplicity's sole business is software - where they know they need to stay ahead to be competitive," added Olivier in conclusion. "That fact, coupled with Synplicity people's record for coming through for us whenever we've needed them, is why we trust them to synthesize our netlists."

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