SYNOPSYS®

Synopsys and NSITEXE

NSITEXE Develops Multiple RISC-V Based Custom Processors for Autonomous Driving SoC with Synopsys' ASIP Designer

" *We were on a tight schedule to develop five complex custom processor models for our multicore data flow processor. By using ASIP Designer and the RISC-V processor models provided with the tool as a starting point, we were able to meet functionality and performance requirements while reducing development time by 50%.* "

~Sadahiro Kimura,
Manager, Semiconductor IP R&D Unit, Advanced Technology Development Section at NSITEXE

NSI-TEXE

Business

NSITEXE specializes in designing and supplying semiconductor IP blocks specific to the automobile and industrial automation spaces. This includes IP and services for its Data Flow Processors (DFP) for customers including automotive tier-1 suppliers and designers of industrial applications and smart household appliances. DFPs enable various applications such as next-generation automotive systems with autonomous drive, robotics, factory automation, and IoT. Executing on this strategy, NSITEXE establishes an innovative design flow aiming for agility and efficiency.

Challenges

- Develop a virtual prototyping solution for its DFP platform targeting autonomous vehicles and connected cars, featuring five application-specific instruction set processors (ASIPs)
- Reduce development time and cost for multiple ASIPs
- In-house processor model development from scratch was not feasible because of tight turnaround time and limited resources

Synopsys Solution

- ASIP Designer

Benefits

- Developed five specialized custom processor models, while reducing design time and number of resources by 50%
- Processor model design was accelerated by starting from RISC-V ISA models provided with ASIP Designer, extended by custom vector extensions
- Automatic generation of software development kit (SDK) and seamless integration of the processors' instruction-set simulators into a SystemC-based virtual prototyping flow enabled efficient system-level verification for this multicore design

Overview

NSITEXE was tasked with developing a virtual prototype for its multicore DFP for early software bring-up and SoC verification. The DFP features five processors designed by NSITEXE, being a combination of RISC-V ISA-based controllers and dedicated vector-processing engines. They used Synopsys' ASIP Designer tool suite to develop these specialized custom processors.

Efficient Application-Specific Processor Design

Because of their aggressive project schedule, NSITEXE knew that it would not be practical to develop a series of processor models from scratch. Having used Synopsys ASIP tools in the past, NSITEXE knew it would enable them to efficiently design and develop their RISC-V based custom processors within a tight deadline and a small development team of just two engineers. Synopsys' ASIP Designer allows users to specify the desired processor architecture (including both the instruction-set and microarchitecture) using nML, a high-level language at the abstraction level of a programmer's manual of a processor. Based on this high-level description, ASIP Designer automatically configures an SDK containing a cycle-accurate instruction-set simulator, assembler, linker, debugger and C/C++ compiler including support for OpenCL C. ASIP Designer comes with a large number of example models written in nML and provided in source code, which serve both as a reference, as well as a starting point for customer-specific designs. NSITEXE started from a RISC-V processor example and made a variety of customizations to develop their highly-specialized vector processors. Thanks to ASIP Designer's ability to export the processor's simulation model with SystemC interfaces, it enabled a rapid setup of a virtual prototype of NSITEXE's multicore DFP.

NSITEXE completed their design with a team of only two engineers in half the time it would have taken to design a custom processor model from scratch. With the successful conclusion of this project, NSITEXE is looking forward to the continued use of ASIP Designer for future projects.

> " *ASIP Designer provided an easy and efficient way for us to create several high-quality custom processors with a limited team of two engineers.* "

~Sadahiro Kimura,
Manager, Semiconductor IP R&D Unit, Advanced Technology Development Section at NSITEXE

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