

Hyunwoo Oh

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EDUCATION

M.S. in Electronic Engineering

2023

Seoul National University of Science and Technology (SEOULTECH)

Seoul, Korea

- Thesis: Research on Optimized Processor and Floating-point Unit Architecture for Embedded Systems

Advisor: Seung Eun Lee

B.S. in Electronic Engineering

2021

Seoul National University of Science and Technology (SEOULTECH)

Seoul, Korea

RESEARCH INTERESTS

Computer Architecture: Exploring novel HW architecture and methodologies to meet the growing computing performance and efficiency demands.

- Heterogeneous Computing: Designing the optimized processor architectures that integrate both emerging parallel machines (PIM, NPU, etc.) and conventional general-purpose processors.
- Compilers: Developing SW compilers optimized for targeted HW designs.

HW/SW Co-Design: Developing techniques for co-optimization to improve energy efficiency and performance.

- Parameterized HW Design Framework: Designing configurable, scalable architectures with RTL generators, compilers, and SW stacks to tailor the HW to system constraints such as power, energy, and area.
- Partitioning Methodology: Investigating a method to derive the parameters to mitigate the impact of Amdahl's law and maximize system performance.

SELECTED PUBLICATIONS [\[SEE ALL ↓↓\]](#)

Peer-Reviewed Conference Papers (2 of 8)

C8. **An SoC FPGA-based Integrated Real-time Image Processor for Uncooled Infrared Focal Plane Array.**

Hyun Woo Oh, Cheol-Ho Choi, Jeong Woo Cha, Hyunmin Choi, Joon Hwan Han, Jung-Ho Shin.

Euromicro Conference on Digital System Design (DSD), Durres, Albania, Sep. 2023. [Accepted] [Long Presentation]

C6. **RF2P: A Lightweight RISC Processor Optimized for Rapid Migration from IEEE-754 to Posit.**

Hyun Woo Oh, Seongmo An, Won Sik Jeong, Seung Eun Lee.

ACM/IEEE International Symposium on Low Power Electronics and Design (ISLPED), Vienna, Austria, Aug. 2023. [Accepted] [Oral Presentation]

Peer-Reviewed Journal Articles (2 of 6)

J6. **The Design of Optimized RISC Processor for Edge Artificial Intelligence Based on Custom Instruction Set Extension.**

Hyun Woo Oh, Seung Eun Lee.

IEEE Access, Vol. 11, pp. 49409-49421, May 2023.

J2. **The Design of a 2D Graphics Accelerator for Embedded Systems.**

Hyun Woo Oh, Ji Kwang Kim, Gwan Beom Hwang, Seung Eun Lee.

Electronics, Vol. 10, No. 4, Feb. 2021.

AWARDS AND HONORS

Academic Scholarship, SEOULTECH

2021

Future Talent Scholarship to pursue a M.S., SEOULTECH

2021 - 2022

President of the Institute of Semiconductor Engineers Award, 21st Korea Semiconductor Design Contest

2020

WORK EXPERIENCE

FPGA & Firmware Engineer, Core H/W Team, Hanwha Systems, Korea

Jan. 2023 - present

- Designed SoC FPGA-based integrated thermal image processor for infrared focal plane arrays. [[DSD 2023 \(C8\)](#)]
 - Designed several AXI4-compliant accelerators for thermal image processing on Zynq Ultrascale+ MPSoC.
 - Developed RTOS firmware based on FreeRTOS with AMP to control the image processor.
 - Designed the PCB schematic for the digital signal processing module, including Zynq Ultrascale+ MPSoC.
- Developed RTOS for Heterogeneous MPSoC (TI TDA3x SoC for ADAS) using the Vision SDK platform.
 - Activated the Control Area Network (CAN) driver to establish communication with automotive processors.
 - Developed the driver for external heater manipulation using the GPIO and timer peripheral.

RESEARCH EXPERIENCE

Research Assistant, SoC Platform Lab., SEOULTECH, Korea

Dec. 2019 - Feb. 2023

Development for Processing Software on AI Semiconductor Devices

Jul. 2022 - Dec. 2022

Ministry of Science and ICT, Korea

- Designed the RISC processor with a custom instruction set extension for flexible AI acceleration running on edge devices. This work includes a scalable AI coprocessor with a parameterized hardware generator. [[IEEE Access 2023 \(J6\)](#)]
- Researched optimized processor and compiler architecture for posit-based FPU support. This work includes scalable arithmetic unit architecture, compiler optimization, and a practical evaluation platform. [[ISLPED 2023 \(C6\)](#)] [[ISOC 2022 \(C5\)](#)]

Development of DRAM PIM Semiconductor Technology For Enhanced Computing Function for Edge

Apr. 2022 - Dec. 2022

Ministry of Science and ICT, Korea

- Designed hierarchical hardware architecture for DRAM-based PIM and software simulator architecture.

Next-Generation System Semiconductor Design Engineer Development Program

Mar. 2021 - Dec. 2022

Ministry of Trade, Industry and Energy, Korea

- Designed local interconnect network (LIN) peripheral IP for ARM Cortex-Mo. My work was synthesis and verification using Synopsys EDA tools, and developing a randomized test pattern generator and peripheral driver. [[ICCE 2022 \(C4\)](#)]

Multi-core Hardware Accelerator for High-Performance Computing (HPC)

Dec. 2019 - Mar. 2022

Ministry of Science and ICT, Korea

- Researched processor architecture to provide a platform for building an accelerator-rich environment. This work includes designing a 32-bit pipelined MIPS core, cache controller, and system bus from scratch and building a GCC-based development environment for the designed processor. [[ISOC 2020 \(C1\)](#)]

Development of Embedded Artificial Intelligence Module and System Based on Neuromorphic

Dec. 2019 - Dec. 2021

Ministry of Trade, Industry and Energy, Korea

- Developed the parameterized hardware generator for an embedded AI module. [[Micromachines 2021 \(J3\)](#)]
- Researched applications of the AI module. [[JICCE 2022 \(J5\)](#)] [[Micromachines 2021 \(J4\)](#)] [[ICFICE 2022 \(C3\)](#)] [[ICCE 2021 \(C2\)](#)]

Development of Light-weight SW-SoC Solution for Respiratory Medical Device

Dec. 2019 - Dec. 2020

Ministry of Trade, Industry and Energy, Korea

- Designed a 2D graphics accelerator architecture optimized for graph visualization tasks in lightweight medical devices. This accelerator was mounted to the processor with ARM Cortex-Mo core and AHB bus. [[Electronics 2021 \(J2\)](#)]
- Developed a software stack for hardware implementation of Lempel-Ziv 77 lossless decompression accelerator. My work was C code-based prototyping, PNG pre-processing software, and evaluation. [[Micromachines 2021 \(J1\)](#)]

Participated in designing several digital VLSI chips using Synopsys EDA tools. [[See list ↴](#)]

TEACHING EXPERIENCE

Teaching Assistant for “Computer Architecture”, SEOULTECH

Fall 2021

- Grading

Teaching Assistant for “Digital System Design”, SEOULTECH

Spring 2021

- Grading, preparation of lab lecture materials

TECHNICAL SKILLS

Computer Programming	Programming Languages	C, C++, Python, Perl, Bash, MATLAB, R*
	Version Control	Git, SVN
	Operating System Development	FreeRTOS, TI Vision SDK, PetaLinux
	Machine Learning Toolkit	Tensorflow*, PyTorch*
	Document Tools	LaTeX, Obsidian (Markdown)
Digital Hardware Design	Hardware Description Language	Verilog, SystemVerilog, Chisel
	Simulation	Verilator, ModelSim
FPGA-based Design	Xilinx FPGA Tools	Vivado, Vitis
	Intel FPGA Tools	Quartus II/Prime, Nios II EDS
Digital VLSI Design	Synopsys EDA Tools	VCS (Simulation), Verdi (Analysis), Formality (Validation)
		Design Compiler (Synthesis), IC Compiler I/II (Layout)
		StarRCXT (Parasitic Extraction), PrimeTime (STA)
	Cadence EDA Tools	Virtuoso Layout Suite* (Layout)
		Calibre DRC*/LVS* (Physical/Layout Verification)
PCB Design	Cadence CAD Tools	OrCAD Capture* (Schematic), Allegro PCB Designer* (Artwork)
Miscellaneous	GUI Programming Framework	Winform/WPF* (C#), JavaFX* (Java), Qt* (C++), Kivy* (Python)
	Mobile Programming	Android* (Java)
	Familiar OS for development	Ubuntu, Windows 10 (with WSL), CentOS

* stands for beginner level.

TRAINING

ISO 26262:2018 Functional Safety Engineering Course: Automotive Foundation Level (FSE-AFL), DNV	2023.01.02-01.04
Design of High-speed Memory Interface, IDEC	2022.12.09
[Synopsys] Block-level Auto P&R utilizing IC Compiler II, IDEC	2021.11.01-11.05
Cell-based Chip Design Flow for Samsung 28nm Process, IDEC	2021.10.19-10.21
Cell-based Chip Design Flow, IDEC	2021.07.05-07.09
[Infineon] Automotive Semiconductor Expert Training - Basic Course, KSIA	2021.06.30-07.02
Cell-based Chip Design Flow, IDEC	2020.08.10-08.14

PROFESSIONAL SERVICES

Reviewer, IEEE Access

2023

MILITARY SERVICE

Full-time Reserve Service

Oct. 2015 - Jul. 2017

Republic of Korea Army

Seoul, Korea

Peer-Reviewed Conference Papers

C8. An SoC FPGA-based Integrated Real-time Image Processor for Uncooled Infrared Focal Plane Array.

Hyun Woo Oh, Cheol-Ho Choi, Jeong Woo Cha, Hyunmin Choi, Joon Hwan Han, Jung-Ho Shin.

Euromicro Conference on Digital System Design (DSD), Durres, Albania, Sep. **2023**. [Accepted] [Long Presentation]

C7. Disparity Refinement Processor Architecture utilizing Horizontal and Vertical Characteristics for Stereo Vision Systems.

Cheol-Ho Choi, **Hyun Woo Oh**.

Euromicro Conference on Digital System Design (DSD), Durres, Albania, Sep. **2023**. [Accepted] [Long Presentation]

C6. RF2P: A Lightweight RISC Processor Optimized for Rapid Migration from IEEE-754 to Posit.

Hyun Woo Oh, Seongmo An, Won Sik Jeong, Seung Eun Lee.

ACM/IEEE International Symposium on Low Power Electronics and Design (ISLPED), Vienna, Austria, Aug. **2023**. [Accepted] [Oral Presentation]

C5. Evaluation of Posit Arithmetic on Machine Learning based on Approximate Exponential Functions.

Hyun Woo Oh, Won Sik Jeong, Seung Eun Lee.

International SoC Design Conference (ISODC), Gangneung, Korea, Oct. **2022**.

C4. A Local Interconnect Network Controller for Resource-Constrained Automotive Devices.

Kwonneung Cho, **Hyun Woo Oh**, Jeongeun Kim, Young Woo Jeong, Seung Eun Lee.

IEEE International Conference on Consumer Electronics (ICCE), Las Vegas, NV, USA, Jan. **2022**.

C3. Intelligent Transportation System based on an Edge AI.

Young Woo Jeong, **Hyun Woo Oh**, Su Yeon Jang, Seung Eun Lee.

International Conference on Future Information & Communication Engineering (ICFICE), Jeju, Korea, Jan. **2022**.

C2. Vision-based Parking Occupation Detecting with Embedded AI Processor.

Kwonneung Cho, **Hyun Woo Oh**, Seung Eun Lee.

IEEE International Conference on Consumer Electronics (ICCE), Las Vegas, NV, USA, Jan. **2021**.

C1. Design of 32-bit Processor for Embedded Systems.

Hyun Woo Oh, Kwon Neung Cho, Seung Eun Lee.

International SoC Design Conference (ISODC), Yeosu, Korea, Oct. **2021**.

Peer-Reviewed Journal Articles

J6. The Design of Optimized RISC Processor for Edge Artificial Intelligence Based on Custom Instruction Set Extension.

Hyun Woo Oh, Seung Eun Lee.

IEEE Access, Vol. 11, pp. 49409-49421, May **2023**.

J5. An Edge AI Device based Intelligent Transportation System.

Youngwoo Jeong, **Hyun Woo Oh**, Soohee Kim, Seung Eun Lee.

Journal of Information and Communication Convergence Engineering, Vol. 20, No. 3, pp. 166-173, Sep. **2022**.

J4. A Multi-Core Controller for an Embedded AI System Supporting Parallel Recognition.

Suyeon Jang, **Hyun Woo Oh**, Young Hyun Yoon, Dong Hyun Hwang, Won Sik Jeong, Seung Eun Lee.

Micromachines, Vol. 12, No. 8, Jul. **2021**.

J3. ASimOV: A Framework for Simulation and Optimization of an Embedded AI Accelerator.

Dong Hyun Hwang, Chang Yeop Han, **Hyun Woo Oh**, Seung Eun Lee.

Micromachines, Vol. 12, No. 7, Jul. **2021**.

J2. The Design of a 2D Graphics Accelerator for Embedded Systems.

Hyun Woo Oh, Ji Kwang Kim, Gwan Beom Hwang, Seung Eun Lee.

Electronics, Vol. 10, No. 4, Feb. **2021**.

J1. Lossless Decompression Accelerator for Embedded Processor with GUI.

Gwan Beom Hwang, Kwon Neung Cho, Chang Yeop Han, **Hyun Woo Oh**, Young Hyun Yoon, Seung Eun Lee.

Micromachines, Vol. 12, No. 2, Jan. **2021**.

A RISC-V Processor Supporting AMBA AXI Protocol for Embedded Systems	Jul. 2022
<ul style="list-style-type: none">• Designer: Won Sik Jeong, Sun Beom Kwon, Hyun Woo Oh, Jeongeun Kim• Technology: Samsung 28nm RFCMOS (1-poly 8-metal)• Role: RTL Verification	
Robot-Specific Processor for Autonomous Driving	Jul. 2022
<ul style="list-style-type: none">• Designer: Youngwoo Jeong, Yue Ri Jeong, Hyun Woo Oh, Kwang Hyun Go• Technology: Samsung 28nm RFCMOS (1-poly 8-metal)• Role: System Verification Assistant	
In-Vehicle Network Processor based on Cortex-Mo	Mar. 2022
<ul style="list-style-type: none">• Designer: Kwon Neung Cho, Jeong Eun Kim, Hyun Woo Oh• Technology: TSMC 180nm RFCMOS (1-poly 6-metal)• Role: System Verification SW Dev., RTL Verification, Pre/Post-Layout Simulation	
A Programmable Embedded AI Processor with Cortex-Mo	Jul. 2021
<ul style="list-style-type: none">• Designer: Kwon Neung Cho, Young Woo Jeong, Hyun Woo Oh, Chang Yeop Han• Technology: Samsung 28nm RFCMOS (1-poly 8-metal)• Role: RTL Subblock Design	
32-bit Processor with Posit Arithmetic Coprocessor for Embedded Systems	Jul. 2021
<ul style="list-style-type: none">• Designer: Hyun Woo Oh, Jeong Eun Kim, Do Young Choi, Kwang Hyun Go• Technology: Samsung 28nm RFCMOS (1-poly 8-metal)• Role: RTL Design & Verification, ASIC Design Front-end/Back-end, Firmware Development, PCB Design & Chip Test	
Implementation of Lossless Decompression Accelerator Based on Inflate Algorithm	Sep. 2020
<ul style="list-style-type: none">• Designer: Gwan Beom Hwang, Do Young Choi, Hyun Woo Oh, Chang Yeop Han• Technology: Samsung 65nm RFCMOS (1-poly 8-metal)• Role: System Verification SW Dev., PCB Design & Chip Test	
Communication System with Simple and Fast Communication Error Check Code Based on CRC	Jun. 2020
<ul style="list-style-type: none">• Designer: Chang Yeo Hanp, Kwon Neung Cho, Hyun Woo Oh• Technology: Magnachip Hynix 0.18um CMOS• Role: RTL Subblock Design	