

# Yingwei Zheng

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## RESEARCH INTERESTS

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**Compiler** (LLVM/MLIR/DSL Compiler)

**High-Performance Computing** (Automatic offloading/scheduling)

**Computer Graphics** (High-performance physically based rendering)

## EXPERIENCES

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**PLCT Lab, Institute of Software Chinese Academy of Sciences (Remote)** Feb. 2023 - present

- Contribute to [LLVM](#) (improve transforms/RISC-V backend)
- Maintain a performance monitoring system for LLVM on RISC-V (<https://lnt.rvperf.org>)

## EDUCATION

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2020 - present Bachelor's Degree at **Southern University of Science and Technology**  
Department of Computer Science and Technology (Turing Class) GPA: 3.9/4.0 (3/218)

## SKILLS

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Programming Languages	Modern C++ (8 years), CUDA (7 years)
Compiler Infrastructure	LLVM (8 years), MLIR
Graphics API	OpenGL/DX11/DX12/Vulkan

## AWARDS

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Nov. 2021	<b>SC21 Student Cluster Competition Highest LINPACK Benchmark</b>	LINPACK Benchmark (1/10), Overall (3/10)
	Contribution: tune LLNL cardioid and achieve 25% speedup on the NVIDIA DGX System	
Nov. 2021	<b>2021 APAC HPC-AI Competition 1st Place &amp; AI Special Prize</b>	Overall (1/36)
	Contribution: tune GROMACS with NVIDIA HPC-X MPI Library	
June 2022	<b>ISC 2022 Student Cluster Competition Online Third Place Winner</b>	Overall (3/16)
	Contribution: (Coding Challenge) optimize Xcompact3d and gain up to 7% performance benefits (0 → 46% overlapping rate) on the cluster equipped with NVIDIA Bluefield DPUs	
Nov. 2022	<b>SC22 IndySCC 2nd Place</b>	Hero HPL Challenge(2/10) Overall (2/10)
	Contribution: Leader/Cluster Maintainer, HPL/HPCG Benchmark	
Aug. 2023	<b>Special Prize of National Compiler Design Competition for College Students 2023</b>	
	Contribution: Leader/Infrastructure/RISC-V backend	RISC-V track (1/26)

## HIGHLIGHTED PROJECTS

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**CMMC** : a dependency-free compiler for the course project of Compilers

- Multiple frontends (Spl/[SysY2022](#))
- Multiple backends (TAC/MIPS32r5/RISC-V/ARMv7)
- Produces competitive results compared with LLVM/GCC
- Won the special prize of the National Computer Design Competition for College Students

**Piper** : a high-performance CPU/GPU physically based renderer

- Spectral rendering (IOR-based dielectric/conductor rendering, dispersion)

- OCIO support (SPD  $\leftrightarrow$  XYZ Color Space  $\leftrightarrow$  sRGB Color Space)
- Embree/OptiX backend (high-performance ray-tracing with SIMD/RT-Core)
- Custom rendering pipeline (real-time preview/NN-based image denoising)

**YAAS** : a sub-object OOB detector for the course project of Computer Security

- Full C/C++17 compatibility (RTTI/exceptions/threading/standard libraries)
- LLVM-based Instrumentation (provided as a built-in option in clang)
- Check GEP instead of LD/ST (detect more access violations than Address Sanitizer)
- Not limited to stack/heap objects (mmap/custom allocators/nested allocators)

**Hive** : a MIPS CPU for the course project of Computer Organization (H)

- Mips32r6 target (most of Integer/FP instructions are supported)
- LLVM-based toolchain
- Modern CPU features (Pipeline/Multiple issue/Out-of-order/Branch prediction/Hardware prefetcher)
- LLVM patch for Hive sub-target to improve instruction scheduling ( $\sim 2\%$  speedup)

**PotatOS** : a tiny RISC-V OS for the course project of Operating Systems (H)

- Written from scratch in modern C++
- SMP support (Work-stealing based scheduler)
- Asynchronous I/O with zero-copy buffers
- Musl libc support

**MiniZip** : an implementation of deflate for the course project of Algorithm Design And Analysis (H)

- Fine-tuned for Intel Rocket Lake CPU
- Optimal algorithm for length-limited huffman encoding
- up to **7x** faster (16 threaded)/**12x** faster (single-threaded) than 7-zip's standard deflate implementation in the same compression ratio