

SEUNGWOO CHOI

ELECTRICAL AND ELECTRONIC ENGINEERING PHD CANDIDATE
QUANTUM SOFTWARE ENGINEER

CONTACT

- seungwoo.choi@yonsei.ac.kr
- +82 10 3446 8559
- Seoul, South Korea
- best-seungwoo.github.io
- linkedin.com/in/best-seungwoo
- github.com/best-seungwoo
- scholar.google.com

EDUCATION & EXPERIENCE

- Mar 2022 – Feb 2028 (Expected)
 - Yonsei Univ. PhD Student
 - Seoul, South Korea Prof. Won Woo Ro
 - Electrical and Electronic Engineering
- Jan 2025 – Jul 2026
 - Rutgers Univ. Visiting Scholar
 - Piscataway, NJ, USA Prof. Yipeng Huang
 - Computer Science
- Mar 2016 – Feb 2022
 - Yonsei Univ. B.S. Graduate
 - Seoul, South Korea GPA: 3.57 / 4.0
 - Electrical and Electronic Engineering

SKILLS

- Quantum SDK
 - Qiskit
 - QDK
 - Cirq
 - PennyLane
- Circuit Simulator
 - qiskit-aer
 - qsimcirq
 - qulacs
 - QuEST
- Software Development
 - Git
 - Shell Script
 - Python
 - C / C++
- Hardware & Parallel
 - Verilog
 - CUDA
- Languages
 - Korean
 - English

SUMMARY

- Quantum Software Expert:** Specialized in quantum circuit simulation, circuit compilation, VQE, and QEC.
- Systems Background:** Strong foundation in classical computer architecture applied to quantum software stack optimization.
- Top-tier Publications:** Proven research excellence through publications in top-tier journals and conferences, including *HPCA*, *TETC*, and *ISCA*.
- Industry Collaboration:** Experienced in industry-partnered research with *Samsung Research* and *Hyundai*.

SELECTED RESEARCH PROJECTS

- [Sep 2025 – Present] QEC-Aware VQE Ansatz Circuit Design**
 - Designing VQE ansatz circuits that preserve physical symmetries within the logical code space to enable effective error detection and correction.
 - Studied various QEC and FTQC frameworks across research and industry.
 - Exploring fault-tolerant code switching technique between complementary transversal gate sets.
- [Jun 2025 – Present] Hardware-Efficient ADAPT-VQE with Gate-Count Aware Operator Selection**
 - Improved hardware efficiency by integrating post-compilation 2-qubit gate counts as a penalty term in the ADAPT-VQE operator selection logic.
 - Studied state-of-the-art ADAPT-VQE and its various variants with hands-on experience using *qiskit*.
 - Studied the SABRE algorithm and gained hands-on experience in layout and routing using *qiskit*.
- [May 2024 – Present] RL-Driven Gate Fusion Optimization**
 - Developed an RL agent to find the optimal gate fusion combinations to accelerate classical simulation.
 - Analyzed and implemented gate fusion techniques from various simulators such as *qiskit-aer*, *qsimcirq*, and *qulacs*.
 - Utilized DAG-based circuit representations to extract features for actual RL agent training.
- [Oct 2023 – Dec 2024] Accelerating UCCSD Circuit Simulation using Merged Gates**
 - Accelerated circuit simulation by replacing patterns of *PauliEvolutionGate* blocks within the UCCSD ansatz with equivalent pseudo 1-qubit gates.
 - Gained a holistic understanding of the entire molecular simulation pipeline, from chemical-to-qubit mapping to circuit implementation.
 - Customized *qiskit-aer* simulation code and executed VQE using the *qiskit* estimator.
- [Mar 2023 – Apr 2024] Memory-Efficient State-Vector Simulation using Polar Form Representation**
 - Enhanced memory efficiency by storing complex coefficients as radius and phase instead of real and imaginary parts.
 - Studied basic concepts of quantum computing and gained experience in using simulators for research.
 - Studied algorithms such as Shor, Grover, QAOA, and VQE to analyze and understand patterns in various benchmark circuits.

PUBLICATIONS

[QMI '26] “Layerwise Retraining and Freezing for **Multi-Angle QAOA**”

Proposed a round-robin layerwise training scheme with selective freezing for efficient Multi-Angle QAOA optimization. ([4th Author](#))

[HPCA '26] “d'ArQ: A **QOC Framework** with Causality-Aware Grouping and Basis Selection”

Proposed a causality-aware grouping algorithm and basis selection to optimize pulse-level quantum control. ([3rd Author](#))

[PRR '25] “Distribution-Adaptive Dynamic **Shot Optimization** for **Variational Quantum Algorithms**”

Developed a history based shot count prediction strategy to reduce VQA measurement cost. ([4th Author](#))

[TETC '25] “q-Point: A Numeric Format for **Quantum Circuit Simulation** using Polar Form Complex Numbers”

Introduced a polar form numeric format to enhance memory efficiency in classical state-vector simulation. ([1st Author](#))

[ISCA '25] “QR-Map: A Map-Based Approach to Quantum Circuit Abstraction for **Qubit Reuse Optimization**”

Designed a qubit reuse framework that abstracts circuits into maps to minimize required physical qubits. ([3rd Author](#))

[CGO '25] “Qubit Movement-**Optimized Program Generation** on Zoned **Neutral Atom Processors**”

Developed circuit optimization techniques to minimize qubit movements on zoned neutral atom processors. ([4th Author](#))

[ASP-DAC '25] “PIMutation: Exploring the Potential of Real PIM Architecture for **Quantum Circuit Simulation**”

Evaluated the effectiveness of Processing-In-Memory (PIM) architectures in accelerating quantum simulation tasks. ([3rd Author](#))

[ICCD '24] “MOSQ: Accelerating **Classical Simulation** of **UCCSD Ansatz** Circuits using Merged Operation”

Accelerated UCCSD ansatz simulation by merging operations based on Pauli evolution patterns. ([1st Author](#))

[ICCAD '24] “Barber: **Balancing Thermal Relaxation** Deviations of NISQ Programs by Exploiting Bit-Inverted Circuits”

Mitigated thermal relaxation errors by combining results from the original circuit and its bit flipped counterpart. ([2nd Author](#))

[PACT '24] “**Recompiling QAOA Circuits** on Various Rotational Directions”

Developed a QAOA recompilation technique that changes rotation bases to reduce post compilation gate count. ([3rd Author](#))

[DAC '23] “**Improving Fidelity** of Quantum Program by Independent Execution of Controlled Gates”

Improved fidelity by running controlled gate dependent subcircuits separately and combining measurement outcomes. ([2nd Author](#))

PATENTS

[US Patent, Pending] “METHOD FOR OPERATING A QUANTUM COMPUTING SYSTEM AND A QUANTUM COMPUTING SYSTEM” (App. No. 18/966,013)

[KR Patent, Pending] “SIMULATION METHOD FOR QUANTUM CIRCUIT AND SIMULATION DEVICE THEREOF” (App. No. 10-2025-0161741)

[KR Patent, Pending] “METHOD FOR OPERATING A QUANTUM COMPUTING SYSTEM AND A QUANTUM COMPUTING SYSTEM” (App. No. 10-2024-0125804)

ACADEMIC SERVICE

Artifact Evaluation

[MICRO '26] Artifact Evaluation Committee

[ASPLOS '25] Artifact Evaluation Committee (Fall)

[ASPLOS '25] Artifact Evaluation Committee (Summer)

Teaching Experience

[Fall 2023, Yonsei] Embedded System Lab (Graduate)

[Fall 2022, Yonsei] Operating System (Undergraduate)

[Spring 2022, Yonsei] Electrical and Electronic Engineering Capstone Design (Undergraduate)

OUTREACH & PRESENTATIONS

Quantum Fellowships & Mentoring

[Spring 2025] IonQ Research Mentoring Program

[Winter 2024] IBM-Yonsei Quantum Challenge

Selected Presentations

[Sep 2025, Rutgers] SQD: Is VQE Being Replaced?

[Aug 2025, Rutgers] Introduction to LDPC-BB Code

[Jan 2025, Yonsei] Reinforcement Learning for Gate Merging Technique

[Aug 2024, Yonsei] VQE: From Computational Chemistry to Quantum Computing

[Mar 2024, Yonsei] Mitigating Memory Bottlenecks in Classical Simulation using Polar Format

[Sep 2023, Yonsei] Tutorial for QAOA: A Top-Down Approach

[Mar 2023, Yonsei] Meaning and Role of Phase in Quantum Computing

[Sep 2022, Yonsei] Quantum Circuit Simulation: Basic Concepts & What We Can Do About It

[Sep 2021, Yonsei] Understanding Shor's Algorithm