**Speaker:** **Jiheon Seong, Korea Advanced Institute of Science and Technology (KAIST)**

**Title:** **Shallow quantum circuits detecting graph states**

**Date:** **Thursday, June 6, 14.30 pm**

**Place:** **Seminar room 915**

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Entanglement is a key resource to achieve quantum advantages. With this motivation, several remarkable attempts have been made in recent years for a large-scale entangled state generation [1,2], which, in turn, directly showcases the error-resilient performance of CNOT gates and calls for a reliable practical scheme for entanglement certification in the context of quantum circuits. In our recently published work [3], we proposed a framework for the design of an entanglement witness circuit (EWC), which is a quantum circuit capable of detecting quantum circuits which generate entanglement. In other words, we transferred the theoretical framework of entanglement detection with entanglement witnesses, namely EW 2.0, into detection scenarios in quantum circuits. The proposed design of EWCs presented in the paper is, however, not scalability-friendly in terms of the circuit depth and the required number of CNOT gates when the system size increases. In this talk, we propose a new shallow quantum circuit which can reliably detect entanglement, particularly the class of graph states, with a single set of measurements. So we will demonstrate how this new architecture resolves the previous drawback and is only linearly-scalable with the number of qubits.

References

[1] Gary J Mooney et al (2021), Generation and verification of 27-qubit Greenberger-Horne-Zeilinger states in a superconducting quantum computer, J. Phys. Commun. 5 095004

[2] Mooney, G.J., White, G.A.L., Hill, C.D. and Hollenberg, L.C.L. (2021), Whole-Device Entanglement in a 65-Qubit Superconducting Quantum Computer. Adv. Quantum Technol., 4: 2100061. https://doi.org/10.1002/qute.202100061

[3] Jiheon Seong, Joonwoo Bae. Detecting Entanglement-Generating Circuits in Cloud-Based Quantum Computing. Intell Comput. 2023;2:0051.DOI:10.34133/icomputing.0051