

HPC simulation of quantum computer

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Simulation framework named “braket” for quantum computer with qubits and gates circuit is developed for massively-parallelized HPC systems using the state-vector method. On the “Fugaku” supercomputer, simulation for 40 qubits circuit is achieved using 1,024 or less nodes, and if its full nodes are available, we will reach 48 qubits with double precision and 51 qubits with byte precision. Simulation time per gate is less than one second, though it takes more for circuits more than about 40 qubits. As an application, quantum variational algorithm is tested for quantum Heisenberg chain with 40 spins, which treats 41 40-qubits circuits and evaluations with system Hamiltonian between the circuits and therefore quantum mechanical state with totally $41 \times 40 = 1640$ qubits is simulated exactly up to numerical accuracy.

Recording and publishing

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