

HPC Simulation of and Simulation on Quantum Computers and Quantum Annealers

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A quantum computer (QC) is a device that performs operations according to the rules of quantum theory. There are various types of QCs of which nowadays the two most important ones considered for practical realization are the gate-based QC and the quantum annealer (QA). Practical realizations of gate-based QCs consist of less than 100 qubits while QAs with more than 2000 qubits are commercially available.

We present results of simulating on the IBM Quantum Experience devices with 5 and 16 qubits, on the CAS-Alibaba device with 11 qubits and on the D-Wave 2X QA with more than 1000 qubits. Simulations of both types of QCs are performed by first modeling them as quantum systems of interacting spin-1/2 particles and then emulating their dynamics by solving the time-dependent Schrödinger equation. Our software allows for the simulation of a 48-qubit gate-based universal QC on the Sunway TaihuLight and K supercomputers.

References:

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