

Day 1 (Poster A)

Daisuke Saida, National Institute of Advanced Industrial Science and Technology (AIST)

Title: Demonstrations of Native Implementation of Boolean Logic Hamiltonian for Quantum Annealing

Abstract:

Native implementation of Boolean Logic Hamiltonians was experimentally demonstrated in the superconducting flux qubits for quantum annealing (QA). We fabricated a QA circuit using superconducting integrated circuit technologies dedicated for superconducting flux qubit, providing Nb 4-layers and a Josephson junction with a critical current density J_c of 1 $\mu\text{A}/\mu\text{m}^2$. Experimental demonstrations of QA were carried out at 10-mK and those results were compared with SPICE analysis. Functionally complete sets of NAND and NOR gates were successfully fabricated as an identical circuit composed of three qubits. Moreover, a native implementation of multiplier consisting of six qubits was also demonstrated experimentally. These native implementations of Hamiltonians consistent with Boolean logic open an efficient and scalable way to apply the QA to satisfiability problem especially like factorization through multiplier Hamiltonian. Further, a proof-of-concept demonstration of hybrid computing architecture, which included domain-specific quantum computing units, was carried out using the QA circuits.