QUANTUM INNOVATION 2021

CP-07-01

Next-generation quantum annealing testbed

William Oliver

EECS, Physics, and Lincoln Laboratory, MIT, USA

Abstract

Quantum annealers based on superconducting flux qubits have generated significant interest as a tool for solving complex optimization problems. However, a demonstration of improved performance over the best known classical algorithms has remained elusive on existing quantum annealing hardware. Hardware improvements such as longer qubit coherence times and enhanced access to key control parameters may be central to achieving a computational advantage. Under DARPA's Reversible Quantum Machine Learning and Simulation (RQMLS) program, MIT Lincoln Laboratory is responsible for operating a state-of-the art quantum annealing testbed. This flexible testbed is fabricated using a 3D-integrated three-tier architecture. It contains 25 high-coherence flux qubits with high-bandwidth individual flux controls (100 MHz) and high-fidelity readout. In this presentation, we will provide an overview of the testbed design and operation.

This research was funded in part by the Office of the Director of National Intelligence (ODNI), Intelligence Advanced Research Projects Activity (IARPA) and the Defense Advanced Research Projects Agency (DARPA) under Air Force Contract No. FA8702-15-D-0001. The views and conclusions contained herein are those of the authors and should not be interpreted as necessarily representing the official policies or endorsements, either expressed or implied, of the ODNI, IARPA, DARPA, or the U.S. Government.