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Best-case performance of quantum annealers on native spin-glass benchmarks: How chaos can affect success probabilities ZHENG ZHU, ANDREW J. OCHOA, Department of Physics and Astronomy, Texas A&M University, FIRAS HAMZE, D-Wave Systems, Inc., STEFAN SCHNABEL, Theoretical Physics Institute, Universitaet Leipzig, HELMUT G. KATZGRABER, Department of Physics and Astronomy, Texas A&M University — Recent tests performed on the D-Wave Two quantum annealer reveal no clear evidence of speedup over conventional technologies. Here, we present results from classical parallel-tempering Monte Carlo simulations of the archetypal benchmark problem, an Ising spin glass, on the native chip topology. Using realistic uncorrelated noise models for the D-Wave Two quantum annealer, we study the best-case fidelity, i.e., the probability that the ground-state configuration is affected by random fields and random bond fluctuations found on the chip. We compute upper-bound success probabilities for different instance classes based on these simple error models and present strategies on how to develop robust and hard benchmark instances.

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