Simulated quantum annealing of double-well and multiwell potentials

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We analyze the performance of quantum annealing as a heuristic optimization method to find the absolute minimum of various continuous models, including landscapes with only two wells and also models with many competing minima and with disorder. The simulations performed using a projective quantum Monte Carlo (QMC) algorithm are compared with those based on the finite-temperature path-integral QMC technique and with classical annealing. We show that the projective QMC algorithm is more efficient than the finite-temperature QMC technique, and that both are inferior to classical annealing if this is performed with appropriate long-range moves. However, as the difficulty of the optimization problem increases, classical annealing loses efficiency, while the projective QMC algorithm keeps stable performance and is finally the most effective optimization tool. We discuss the implications of our results for the outstanding problem of testing the efficiency of adiabatic quantum computers using stochastic simulations performed on classical computers.