

Some Topics in Quantum Annealing

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It has been expected that quantum information processing enables us to solve complicated optimization problems. Many algorithms for individual problems have been proposed by a number of researchers. Quantum annealing, a kind of quantum information processing, was developed in terms of statistical physics. Quantum annealing is regarded as an alternating method of simulated annealing which has been widely adopted for optimization problems. In the simulated annealing, we can obtain better solutions of optimization problems by decreasing temperature (thermal fluctuation), whereas by decreasing quantum field (quantum fluctuation), better solutions can be obtained in the quantum annealing. We demonstrated the performance of quantum annealing by using some numerical methods such as exact diagonalization, mean-field calculation, and Monte Carlo simulation [1-5]. We also considered hybrid type of quantum annealing in which we control both thermal fluctuation and quantum fluctuation simultaneously [6,7]. Study on quantum annealing is strongly related not only to understanding quantum information processing itself but also to investigate properties of fluctuation effect from a viewpoint of quantum statistical physics.

References

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