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Error suppression and correction for quantum annealing

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While adiabatic quantum computing and quantum annealing enjoy a certain degree of inherent robustness against excitations and control errors, there is no escaping the need for error correction or suppression. In this talk I will give an overview of our work on the development of such error correction and suppression methods. We have experimentally tested one such method combining encoding, energy penalties and decoding, on a D-Wave Two processor, with encouraging results. Mean field theory shows that this can be explained in terms of a softening of the closing of the gap due to the energy penalty, resulting in protection against excitations that occur near the quantum critical point. Decoding recovers population from excited states and enhances the success probability of quantum annealing. Moreover, we have demonstrated that using repetition codes with increasing code distance can lower the effective temperature of the annealer.

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