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Dimensionality reduction for adiabatic quantum optimizer in presence of local disorder GIAN GIACOMO GUERRESCHI, SALVATORE MANDRÀ, ALÁN ASPURU-GUZIĆ, Harvard Univ — Adiabatic quantum optimization (AQO) is a procedure to solve a vast class of optimization problems by slowly changing the Hamiltonian of a quantum system. The evolution time necessary for the algorithm to be successful scales inversely with the minimum energy gap encountered during the dynamics. Unfortunately, the direct calculation of such gap is strongly limited by the exponential growth in dimensionality of quantum systems. Although many special-purpose methods have been devised to reduce the effective dimensionality of the Hilbert space, they are strongly limited to particular classes of problems with evident symmetries. Here, we propose and implement a reduction method that does not rely on any explicit symmetry and which requires, under certain but quite general conditions, only a polynomial amount of classical resources. A natural and important application is the analysis of AQO in presence of local disorder. In this respect, we show that AQO, even when affected by random noise, can still be faster than any classical algorithm.

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