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Study the structure of local Hamiltonian on adiabatic quantum computation

The different encoding structures of initial Hamiltonian, final Hamiltonian and extra Hamiltonian can affect the efficiency of adiabatic quantum computation (AQC). As a matter of fact, all have done is to modify the structure of local Hamiltonian, which is the time-dependent Hamiltonian during the adiabatic evolution. In this paper, we clarify the link between the structure of local Hamiltonian and the efficiency of AQC. On one hand, we analyze the reason why an adiabatic algorithm can have a good or bad performance by using a conventional equivalent approximation, and find the structure of the local Hamiltonian must contain the flipping matrix to keep an efficient evolution in AQC. On the other hand, we discuss the relationship between the evolution time complexity and the structure of local Hamiltonian, and it shows the time complexity is depended on the relevant backdiagonal elements of the local Hamiltonian matrix. This may help us better understand the adiabatic analogue of resources required in adiabatic evolution model, just like the number of operations does for conventional quantum computing.