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Improved Bounds for Eigenpath Traversal HAO-TIEN CHIANG, Univ of New Mexico, GUANLEI XU, University of Pittsburgh, ROLANDO SOMMA, Los Alamos National Lab — We present an improved bound on the length of the path defined by the ground states of a continuous family of Hamiltonians in terms of the spectral gap Δ. We use this bound to obtain a better cost of recently proposed methods for quantum adiabatic state transformations and eigenpath traversal. In particular, we prove that a method based on evolution randomization, which is a simple extension of adiabatic quantum computation, has an average cost of order $1/\Delta^2$, and a method based on fixed-point search has a maximum cost of order $1/\Delta^{3/2}$. Additionally, if the Hamiltonians satisfy a frustration-free property, such costs can be further improved to order $1/\Delta^{3/2}$ and $1/\Delta$, respectively. Our methods offer an important advantage over adiabatic quantum computation when the gap is small, where the cost is of order $1/\Delta^3$.

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