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Effect of error tolerance probability to the fidelity of a 4-qubit quantum search simulation

We simulate the optimized fixed-point quantum search (OFPQS) algorithm with first- and second-nearest neighbor interactions in a 4-qubit Ising spin system using a nonrefocusing technique. In order to perform a single qubit gate, we utilize the coupling interactions to control the neighboring spins. The phase-marking scheme of the OFPQS is implemented using a single rotation about the transverse axis instead of the usual rotation about the field axis. Furthermore, the state of the ancilla is initialized in a superposition of the basis states to avoid the generation of unwanted states. This procedure gives us a probability of finding the target state within the prescribed bound of the OFPQS. Based on this scheme, we investigate the effect of error tolerance probability of the OFPQS to the fidelity of the nonrefocusing implementation.

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