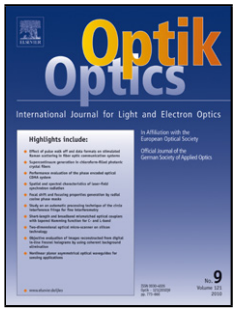

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Rapid state transfer for a two-level non-Markovian quantum system

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Abstract

In quantum information processing, rapid control is a basic requirement for performance improvement because a realistic quantum system cannot be perfectly separated from its environment, which will cause relaxation or decoherence effect. Rapid control may make the control law more robust to uncertainties in the model or in the control process. From the time optimization standpoint, bang-bang control is an excellent method for engineering practice. However, quantum bang-bang control relies on quantum Zeno effect, quantum anti-Zeno effect will occur under low measurement frequency, which intensifies the decoherence and leads to high-frequency oscillation phenomenon. In order to realize rapid state transfer and avoid high-frequency oscillation with an infinitesimal period in bang-bang Lyapunov control, we design control fields to realize arbitrary state transfer for non-Markovian system with phase relaxation and energy dissipative relaxation by Lyapunov stability theory. The numerical simulations illustrate that arbitrary state (eigenstate, superposition state or mixed state) transfer and maintenance for non-Markovian system can be realized under the approximate bang-bang Lyapunov control.

Keywords: rapid state transfer; non-Markovian system; Lyapunov control; approximate bang-bang control.

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