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Optimal control and selectivity of qubits in contact with a structured environment

mardi 27 juin 2023 14:00 (1 heure)

This talk is devoted to the presentation of the results reported in Phys. Rev. A 106, 043702 (2022). In this article, we present a theoretical study of the optimal control of a qubit interacting with a structured environment. We consider a model system in which the bath is a bosonic reservoir at zero temperature and the qubit frequency is the only control parameter. Using optimal control techniques, we show the extent to which qubit population and relaxation effects can be manipulated. The reachable qubit states by a shaped control with a fixed maximum intensity are found numerically. We analyze the role of standard control mechanisms and the structure of the set of reachable states with respect to the coupling strength between the system and the environment. This investigation is used as a starting point to explore the selectivity problem of two uncoupled qubits interacting with their own baths and characterized by a specific coupling strength. We numerically derive the optimal control solution for a wide range of parameters and we show that the control law is close to a sinusoidal function with a specific frequency in some peculiar cases.

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