Quantum Control of Two Vibrational Qubit Gates

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The manipulation of molecular systems aiming at the implementation of quantum logic gates has proven to be a major challenge today. There are countless control methods that can be implemented for this purpose. A particularly simple and low-computational technique is the piecewise time-independent control (PTIC). In this contribution we aim to control the vibrational population transfer of the OH molecule, coding logic gates in a four-level system, that is, promoting transitions between two correlated qubits. Initially, we prepared the state of Bell for two interacting qubits, constituting a system of four computational states, and associate with the molecular vibrational levels of the functional hydroxide. From the mentioned procedures, we divided the present study into two stages. First we control the path prescribed by the vibrational populations (associated with the logic gates) in an isolated system. Then, based on an analog configuration, we manipulate the same logic gates in an open system (correlated qubits), comparing the obtained results with each other. We determined the electric field intensity profiles (constant at small time intervals) in both perspectives, as well as the populations associated with the qubits. We show that the CPP method is robust in the quantum control of molecular systems applied to quantum computing.