



Hamzi Jirari

(CNRS, Université Joseph Fourier, Grenoble, France)

Quantum Brachistochrone

We investigate the application of optimal control of single-qubit coupled to an ohmic heat bath. For the weak bath coupling regime, we derive a Bloch-Redfield master equation describing the evolution of the qubit state parameterized by vectors in the Bloch sphere. By use of the optimal control methodology we determine the field that generates a single qubit rotation. We use the techniques of automatic differentiation to compute the gradient for the cost functional. We consider also the concept of "Quantum Brachistochrone". Here the problem naturally arises of determining the minimal transition time between an initial state and a final state. The optimal control is of "bang-bang" type and switches from the upper to the lower value of the control bounds.

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Universität Ulm, Raum N25/4413
Albert-Einstein-Allee 11, 89081 Ulm

