Geometric optimal control of dissipative two-level quantum systems

Dominique Sugny

Institut Carnot de Bourgogne, UMR CNRS 5209 9 Avenue Alain Savary, BP 47 870 F-21078 DIJON Cedex FRANCE

e-mail: dominique.sugny@u-bourgogne.fr

We apply recent developments in geometric optimal control to analyze the time minimum control problem of dissipative two-level quantum systems whose dynamics is governed by the Lindblad equation. We show how to solve the optimal control problem for all values of the dissipative parameters. We use the Pontryagin maximum principle to select extremal trajectories, candidates as minimizers and solutions of an Hamiltonian equation. Second-order conditions using the variation equation allow to determine first conjugate points forming the conjugate locus which are points where extremals cease to be locally optimal. Different cases will be detailed: the case where the Rabi frequency is real, the case where the Hamiltonian dynamics is integrable and the generic case through numerical simulations.