Geometry and Dynamics of Algorithms on the Quantum Information Space

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Abstract

Quantum computation and quantum information are known well to be very hot interdisciplinary fields [1], where a number of approaches have been taken. In a series of papers [2, 3, 4, 5], the author takes geometric and dynamical-system approaches to differential equations on the quantum information space (QIS) raised from algorithms in engineering.

One of the keys to the papers is the fact that the SLD-Fisher metric of the QIS is obtained from the natural Riemannian metric of the space of ordered tuples of multiqubits through a geometric reduction [2]. On the QIS, three types of geodesics are of much interest; the m-geodesics, the e-geodesics and the Levi-Civita geodesics. As a continuation of the paper [5] showing that the Grover search geodesic for a given ordered tuple of multiqubits is reduced to an m-geodesic on the QIS, this talk presents presents the classes curves which are reduced to the m-, the e-, and the Levi-Civita geodesics on the QIS. In particular, the curves related with the m-geodesics are discussed in detail.

Since the QIS consists of positive-(semi)definite matrices with unit trace, computer algebra would be worth applying to matrix computations on the QIS. Applicability of computer algebra will be discussed also in this talk.

Keywords
Quantum information space, Geodesics, Gradient flow, Algorithms

References


