Physical Realizability of Quantum Stochastic Differential Equations as N-level Open Quantum Systems

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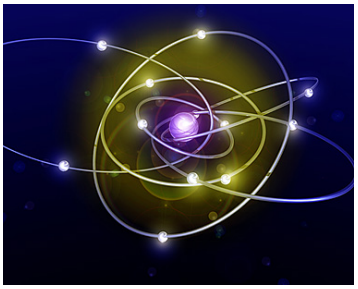

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Abstract

In the last twenty years, quantum control has become critical for the development of quantum and nano technologies. However, most approaches such as measurement base quantum control consider, for example, a classical controller in the feedback loop. In this context, coherent quantum control considers purely quantum systems in order to overcome disadvantages such as the acquisition of suitable quantum information, quantum error correction, etc. Unfortunately, current approaches lack a systematic characterization of the ``quantumness'' of systems. Such characterization is provided by the property of ``physical realizability'', which has been fully studied for linear quantum systems. The purpose of this talk is to address the problem of physical realizability specifically for n-level quantum systems. Concretely, the goal is to develop necessary and sufficient conditions for quantum stochastic differential equations ensuring the existence of physical parameters characterizing the unitary evolution required by the laws of quantum mechanics. The framework of quantum differential equations provides a convenient mathematical description which allows the translation of standard control techniques into a quantum mechanical setting. Also, these conditions guarantee the preservation of the commutation and anticommutation relations of the underlying algebra SU(n).

Biosketch

Luis A. Duffaut Espinosa received the Ph.D. degree in Electrical and Computer Engineering from Old Dominion University in 2009. He also received the M.S. and B.S. degrees from the department of Mathematics at Pontifical Catholic University of Peru and the school of Physics at National University on Engineering in Peru, respectively. Also, he has held postdoctoral positions at Old Dominion University and Johns Hopkins University, and has been a Research Associate at the University of New South Wales at ADFA in Australia. Some of his research interests are in control theory for nonlinear systems, stochastic processes, algebraic combinatorics and quantum control.