



Contribution ID : 94

Type : invited

Introduction to quantum control methods for Quantum Technologies

giovedì 1 settembre 2022 16:00 (90)

The ability to accurately control a quantum system (Quantum Control) is a fundamental requirement in the development of quantum technologies, with applications ranging from quantum information processing to high-precision measurements. Very often quantum control aims at reaching a given target state, implementing a quantum gate, or the cooling of atomic ensembles and nanomechanical oscillators. In these lectures I will introduce some well established methods as well as some recently developed methods that are used to perform Quantum Control. In particular I will explain: 1) Transitionless Quantum Driving (or Shortcut to Adiabaticity), 2) Quantum Optimal Control, and 3) Reinforcement Learning. As an example, I will show the application of these methods to the problem of population transfer in a three-level Λ system.

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Session Classification : Session 9