Journées QUACO 2023

Rapport sur les contributions

https://indico.math.cnrs.fr/e/9816

ID de Contribution: **1** Type: **Non spécifié**

Optimal control of quantum systems: Applications to the robust control of Bose-Einstein Condensates and to quantum speed limit with piecewise constant control

lundi 26 juin 2023 11:00 (1 heure)

See attached file

Orateur: DIONNIS, Etienne

ID de Contribution: **2** Type: **Non spécifié**

Welcome speech

lundi 26 juin 2023 10:30 (30 minutes)

ID de Contribution: **3** Type: **Non spécifié**

Controlling quantum systems by their boundaries

lundi 26 juin 2023 15:00 (1 heure)

On this talk, the possibility of controlling quantum systems by means of boundary conditions will be addressed. We will present the problem of controlling the pure state of a quantum particle via boundary conditions using two examples: the case of a circuit-like space and the case of a potential well with moving walls. For the first case, we show approximate controllability using as space of controls a family of boundary conditions which are a generalisation of quasi-delta vertex conditions on Quantum Graphs. On the second case, we show controllability using as controls the movement of one or both of the well's walls.

Orateur: BALMASEDA, Aitor

ID de Contribution: **4** Type: **Non spécifié**

On the stability of the Schrödinger equation and applications to Quantum Control

lundi 26 juin 2023 14:00 (1 heure)

I will present a stability result for the non-autonomous Schrödinger equation that improves previously known results that date back to the 1970's. In particular, we have obtained a sharper bound for the estimates.
Based on these stability results I will present several applications to Quantum Control of infinite dimensional systems with possibly time-dependent domains for the operators.
This is joint work with A. Balmaseda and D. Lonigro.

Orateur: PEREZ PADRO, Juan Manuel

ID de Contribution: **5** Type: **Non spécifié**

Controllability and weak conical connectedness of the spectrum for control-affine quantum systems

lundi 26 juin 2023 16:30 (1 heure)

We explore the controllability of a closed control-affine quantum system driven by two external fields. The controllability properties of such a system are known to be closely related to its spectrum, seen as a function of the control. Previous studies have demonstrated that a spectrum connected by non-overlapping conical intersections yields exact controllability in the finite-dimensional case and approximate controllability in the infinite-dimensional case. Generically, intersections between two eigenvalues are conical and non-overlapping. However, in physical situations, due to symmetry of the system, the spectrum can exhibit both conical and semi-conical intersections, with some intersections overlapping. We refer to this as a "weakly conically connected"spectrum. We show that when the overlapping intersections have "rationally unrelated germs"at each intersection point, the same controllability properties can still be obtained. Finally, we provide a testable first-order sufficient condition for controllability.

Orateur: LIANG, Ruikang

ID de Contribution: **6** Type: **Non spécifié**

Well-posedness and quasi-adiabatic control of the Schrödinger equation by deformations of the domain

mardi 27 juin 2023 09:30 (1 heure)

Abstract: see attached file

Orateur: DUCA, Alessandro

ID de Contribution: **7** Type: **Non spécifié**

Indirect Controllability of Two Interacting Qubits in the Presence of Dissipation: A First Analysis.

mardi 27 juin 2023 11:00 (1 heure)

We consider a bipartite open quantum system consisting of two interacting qubits, denoted by A and B, respectively. We assume that qubit A is coupled to the environment and is directly affected by coherent control, while qubit B does not interact directly with the environment and the control fields. We are interested in the
controllability properties of subsystem B.

We provide a first analysis of the problem and give some negative answers.

Orateur: VERZHANSKA, Kateryna

ID de Contribution: **8** Type: **Non spécifié**

Optimal control and selectivity of qubits in contact with a structured environment

mardi 27 juin 2023 14:00 (1 heure)

This talk is devoted to the presentation of the results reported in Phys. Rev. A 106, 043702 (2022). In this article, we present a theoretical study of the optimal control of a qubit interacting with a structured environment. We consider a model system in which the bath is a bosonic reservoir at zero temperature and the qubit frequency is the only control parameter. Using optimal control techniques, we show the extent to which qubit population and relaxation effects can be manipulated. The reachable qubit states by a shaped control with a fixed maximum intensity are found numerically. We analyze the role of standard control mechanisms and the structure of the set of reachable states with respect to the coupling strength between the system and the environment. This investigation is used as a starting point to explore the selectivity problem of two uncoupled qubits interacting with their own baths and characterized by a specific coupling strength. We numerically derive the optimal control solution for a wide range of parameters and we show that the control law is close to a sinusoidal function with a specific frequency in some peculiar cases.

Orateur: ANSEL, Quentin

ID de Contribution: **9** Type: **Non spécifié**

Discussion and conclusion

ID de Contribution: **10** Type: **Non spécifié**

Small-time global approximate controllability of bilinear wave equations

mardi 27 juin 2023 15:00 (1 heure)

In this talk we will consider a multi-input bilinear control problem for the wave equation on a torus of arbitrary dimension. We will see that the system is globally approximately controllable in arbitrarily small times, from any initial state with a finite number of active modes. We will also discuss the control strategy, which is explicit, and based on a small-time limit of conjugated dynamics to move along non-directly accessible directions (a.k.a. Lie brackets of the generators).

Orateur: POZZOLI, Eugenio