Offer #2022-04731

Post-Doctoral Research Visit F/M Adiabatic control of quantum systems in presence of decoherence

Level of qualifications required : PhD or equivalent

Fonction : Post-Doctoral Research Visit

Context

The postdoc, of the duration of 24 months, will take place in the framework of the **Défi Inria EQIP** (Engineering for quantum information processors). It will be supervised by two Inria teams CAGE (Inria center of Paris), McTAO (Inria center of Sophia-Antipolis).

The postodc is expected to spend one year in Paris working as a member of the team CAGE and one in Sophia-Antipolis as a member of the team McTAO. Frequent travels of the postdoc between the two teams are expected (and will be convered by the two teams).

The postdoc is expected to collaborate with several members of the two teams: Ugo Boscain (CAGE), Jean-Baptiste Pomet (McTAO), Ludovic Sacchelli (McTAO), Mario Sigalotti (CAGE).

Assignment

Adiabatic theory is a powerful tool in quantum control, yielding robust control strategies. The adiabatic theorem establishes that for a slowly varying self-adjoint Hamiltonian without eigenvalue intersections a trajectory starting from an eigenvector follows approximately the instantaneous eigenvector. Extensions of the adiabatic theorem permit to treat also the case with eigenvalue intersections; these allow the creation and control of population transfers between energy levels of the Hamiltonian. When the Hamiltonian is driven by two real-valued controls, the eigenvalue intersections of the Hamiltonian are generically conical. The efficiency and robustness of adiabatic strategies, demonstrated so far for closed quantum systems, make it very tempting to apply them to the case of open quantum systems. In this respect there are two different types of models describing the loss of coherence, to which adiabatic techniques can be applied: either one uses the Lindblad formalism and describes the evolution of the density matrix, or one studies a simpler model, on which this project will focus (at least in a first phase), where the decoherence is described by non-self-adjoint terms in the controlled Hamiltonian. Extensions of the adiabatic approach to the case of non-self-adjoint Hamiltonians exist [1,2], but their applicability to control of quantum mechanical systems is still not fully analyzed. The objective of the postdoc is to develop a systematic analysis of adiabatic control protocols for dispersive systems with and without parametric distribution, based on spectral properties of non-self adjoint controlled Hamiltonians.

[1] Nenciu, G., Rasche, G., On the adiabatic theorem for non self-adjoint Hamiltonians, J. Phys. A, 25, pp. 5741–5751, 1992.

[2] A. Joye, General Adiabatic Evolution with a Gap Condition, Communications in Mathematical Physics, volume 275, pp. 139–162, 2007.

Main activities

The postdoc will contribute to the development of adiabatic control strategies for dispersive systems. He/she will pursue different research lines proposed by the two teams, expanding if necessary her/his background in singularity theory and averaging of dynamical systems.

Skills

The candidate should have a strong mathematical background, incuding in particular nonlinear control theory. Previous knowledge of the basics of quantum physics will be highly appriciated.

The candidate should also be willing to participate to a collaborative project between two team in different cities, accepting travel and bi-localization constraints.

Benefits package

- Subsidized meals
- Partial reimbursement of public transport costs
- Leave: 7 weeks of annual leave + 10 extra days off due to RTT (statutory reduction in working hours) + possibility of exceptional leave (sick children, moving home, etc.)
- Possibility of teleworking and flexible organization of working hours
- Professional equipment available (videoconferencing, loan of computer equipment, etc.)
- Social, cultural and sports events and activities
- Access to vocational training

General Information

- **Theme/Domain :** Optimization and control of dynamic systems
- **Town/city :** Paris
- **Inria Center :** Centre Inria de Paris
- **Starting date :** 2022-10-01
- **Duration of contract :** 2 years
- **Deadline to apply :** 2022-10-31

Contacts

- **Inria Team :** CAGE
- **Recruiter :**
  Sigalotti Mario / Mario.Sigalotti@inria.fr

About Inria

Inria is the French national research institute dedicated to digital science and technology. It employs 2,600 people. Its 200 agile project teams, generally run jointly with academic partners, include more than 3,500 scientists and engineers working to meet the challenges of digital technology, often at the interface with other disciplines. The Institute also employs numerous talents in over forty different professions. 900 research support staff contribute to the preparation and development of scientific and entrepreneurial projects that have a worldwide impact.

Warning : you must enter your e-mail address in order to save your application to Inria. Applications must be submitted online on the Inria website. Processing of applications sent from other channels is not guaranteed.

Instruction to apply

Defence Security :
This position is likely to be situated in a restricted area (ZRR), as defined in Decree No. 2011-1425 relating to the protection of national scientific and technical potential (PPST).Authorisation to enter an area is granted by the director of the unit, following a favourable Ministerial decision, as defined in the decree of 3 July 2012 relating to the PPST. An unfavourable Ministerial decision in respect of a position situated in a ZRR would result in the cancellation of the appointment.

Recruitment Policy :
As part of its diversity policy, all Inria positions are accessible to people with disabilities.