Offer #2024-07727

PhD Position F/M Robust control of several classes of delay systems

Contract type: Fixed-term contract

Level of qualifications required: Graduate degree or equivalent

Fonction: PhD Position

About the research centre or Inria department

The Inria Saclay-Île-de-France Research Centre was established in 2008. It has developed as part of the Saclay site in partnership with Paris-Saclay University and with the Institut Polytechnique de Paris since 2021.

The centre has 39 project teams, 27 of which operate jointly with Paris-Saclay University and the Institut Polytechnique de Paris. Its activities occupy over 600 scientists and research and innovation support staff, including 54 different nationalities.

Context

The DISCO team has great expertise in the study of delay systems by input-output and time domain methods in the linear and nonlinear settings. Questions of primary importance include stability analysis, robust control and reduced complexity controllers.

Assignment

Delays are strongly involved in challenging areas of communication and information technologies. From a mathematical point of view, the presence of delays makes it difficult to characterize the stability of dynamical systems. When working in the frequency domain and analyzing the transfer function of such dynamical systems, we are faced to the problem of locating the poles of the transfer function in the complex plane: they are zeros of quasi-polynomials and indeed in infinite number. Since stability requires having no poles in the closed right half-plane, a question of prime interest is the presence or the absence of poles in the closed right half-plane.

The seminal work of Bellman & Cooke 1 allowed to define two classes of systems: the class of retarded delay systems which have a finite number of poles in the closed right half-plane and the class of neutral systems which may have an infinite number of poles in the closed right half-plane (distributed as chains of poles asymptotic to vertical lines in the complex plane together with poles of small modulus).

The objective of this thesis is to progress on the stabilization properties of delay systems of the neutral type as well as on the determination of robust controllers for them.

Main activities

We will in particular study the existence of coprime factorizations for such systems. This will allow us to propose infinite-dimensional as well as finite-dimensional controllers. Such results will be of importance for the robust control of hyperbolic PDEs.

An implementation of some obtained results in the Matlab toolbox YALT or the Python Toolbox YALTAPy would be a plus.

Skills

We are looking for candidates with a very good level in mathematics / systems theory. Skills in Maple/Python/Scilab would be appreciated.

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
- Social security coverage

**Remuneration**

2100 € gross/month

**General Information**

- **Theme/Domain**: Scientific computing (BAP E)
- **Town/city**: Gif-sur-yvette
- **Inria Center**: Centre Inria de Saclay
- **Starting date**: 2024-10-01
- **Duration of contract**: 3 years
- **Deadline to apply**: 2024-06-01

**Contacts**

- **Inria Team**: DISCO
- **PhD Supervisor**: Bonnet Catherine / Catherine.Bonnet@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.