Offer #2025-08770

Post-Doctoral Research Visit F/M Postdoctoral Position -- Discrete-time output feedback sliding mode methods.

Contract type : Fixed-term contract

Level of qualifications required : PhD or equivalent

Fonction : Post-Doctoral Research Visit

About the research centre or Inria department

The Inria Grenoble research center groups together almost 600 people in 23 research teams and 7 research support departments.

Staff is present on three campuses in Grenoble, in close collaboration with other research and higher education institutions (University Grenoble Alpes, CNRS, CEA, INRAE, …), but also with key economic players in the area.

Inria Grenoble is active in the fields of high-performance computing, verification and embedded systems, modeling of the environment at multiple levels, and data science and artificial intelligence. The center is a top-level scientific institute with an extensive network of international collaborations in Europe and the rest of the world.

Context

Within the framework of the ANR SlimDisc collaborative project between Centre Inria de l'Université Grenoble Alpes, Inria Lille, and Ecole Central de Nantes.

The TRIPOP team is a joint research team of Centre Inria de l'Université Grenoble Alpes and of the Laboratoire Jean Kuntzmann (LJK). This new team is a follow up of the BIPOP team (2003–2017).

The team is mainly concerned with the modeling, the mathematical analysis, the simulation and the control of nonsmooth dynamical systems. Nonsmooth dynamics concerns the study of the time evolution of systems that are not smooth in the mathematical sense, i.e., systems that are characterized by a lack of differentiability, either of the mappings in their formulations, or of their solutions with respect to time.The team is one of the few in the world that has brought together researchers in applied maths, control theory, computational mechanics and scientific computing in the field of nonsmooth dynamics. In mechanics, the main instances of nonsmooth dynamical systems are multibody systems with Signorini unilateral contact, set-valued (Coulomb-like) friction and impacts. In Electronics, examples are found in switched electrical circuits withe ideal components (diodes, switches, transistors). In Control, nonsmooth systems arise in the sliding mode control theory and in optimal control. A lot of examples can also be found in cyber-physical systems (hybrid systems), in transportation sciences, in mathematical biology or in finance.

Assignment

The selected candidate will be responsible for developing controllers for finite-dimensional dynamical systems, employing set-valued sliding-mode state observers and/or differentiators implemented in discrete time. Additionally, the candidate will perform the associated theoretical analyses of the resulting closed-loop.

The primary challenge involves investigating how discretization affects the closed-loop behavior, specifically concerning stability and robustness properties. This will include analyzing which components of the closed-loop system (observer and/or controller) are best suited for discretization methods such as backward Euler or semi-implicit methods.

Another objective is the development of a software package designed for the simulation and real-time computation of set-valued controllers and observers/differentiators using specific discretization techniques (e.g., backward Euler, semi-implicit methods). This task requires developing appropriate numerical solvers suitable for practitioners who may not have extensive knowledge of the underlying theoretical concepts.

Main activities

The main activities of the selected candidate include:

- To study the state-of-the-art bibliography on the subject.

- To propose ideas for the analysis and design of the mathematical models under consideration.
- To make numerical simulations to illustrate the suitability of the developed methods.
- To develop a software library in Python for the numerical implementation of discrete-time sliding mode observers/controllers/differentiators.
- To write internal reports, scientific papers.
- To present the obtained results in scientific events, (conferences, seminars, workshops, etc).

Name of supervisors:

Félix A. Miranda-Villatoro (TRIPOP team, Centre Inria de l'Université Grenoble Alpes)

Bernard Brogliato (TRIPOP team, Centre Inria de l'Université Grenoble Alpes)

Skills

Technical skills and level required : PhD in automatic control, applied mathematics, or a related area.

Languages : English, French.

Other valued appreciated : Knowledge on convex optimization algorithms and programming skills in Python, C++.

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 (90 days / year) 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
- Complementary health insurance under conditions

Remuneration

2788€ gross salary / month

General Information

- **Theme/Domain :** Optimization and control of dynamic systems
- **Town/city :** Montbonnot
- **Inria Center :** Centre Inria de l'Université Grenoble Alpes
- **Starting date :** 2025-09-01
- **Duration of contract :** 2 years
- **Deadline to apply :** 2025-04-30

Contacts

- **Inria Team :** TRIPOP
- **Recruiter :**
  Miranda Villatoro Felix / felix.miranda-villatoro@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.

The keys to success

Interested candidates must hold a PhD in control theory, applied mathematics, or a closely related field.

Candidates are required to have a solid mathematical background, with knowledge of dynamical systems and proficiency in standard linear and nonlinear control methodologies (e.g., Lyapunov methods, sliding mode control). Programming skills in Python (or C++), are highly desirable and knowledge on convex optimization algortihms would be advantageous.

Excellent proficiency in English, including strong academic writing skills, is also required.

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

Applications must be submitted online on the Inria website.

Processing of applications sent by other channels is not guaranteed.

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.