



Offer #2024-08266

Flatness method for the control of coupled systems or with a free boundary

Contract type : Internship agreement

Level of qualifications required : Graduate degree or equivalent

Fonction : Internship Research

Context

The objective is to work on the flatness method for systems of partial differential equations.

Many results have already been obtained in the literature but in general it involves controlling a single partial differential equation. We wish to extend these results to the case of coupled systems, if possible having a general approach allowing us to treat an entire class of systems. We also want to work on nonlinear problems and in particular problems with free boundaries.

Assignment

The recruited person will work with Jérôme Lohéac and Takéo Takahashi. To get an idea of the subject, we can refer to the articles

<https://hal.science/hal-03721544v1>

<https://hal.science/hal-03969875v2>

<https://hal.science/hal-04119834v1>

in which we work on Stefan's problem, a cross-diffusion problem in the presence of a free boundary and a system of two coupled heat equations.

During the internship, we wish to extend this result that we obtained on the coupling of two equations to a coupling of a finite number of heat equations. Eventually we can first consider the case of a cascade system. We also want to look at the case where the coupling takes place at the boundary of the domain.

Main activities

Main activities:

- Read the references on the subject
- Present the results regularly
- Writing the work achieved in latex

Skills

Technical skills and level required: a good level of knowledge in the analysis of partial differential equations. Possibly some knowledge of control theory would be a plus.

Languages: a decent level of English to write articles and present your work in English if necessary

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 (after 6 months of employment) 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

Internship bonus: €4.35/hour (plus or minus €670/month)

Remuneration for thesis: €2100 gross/month the 1st year

General Information

- **Theme/Domain** : Optimization and control of dynamic systems
Scientific computing (BAP E)
- **Town/city** : Villers lès Nancy
- **Inria Center** : [Centre Inria de l'Université de Lorraine](#)
- **Starting date** : 2025-03-01
- **Duration of contract** : 6 months
- **Deadline to apply** : 2024-12-01

Contacts

- **Inria Team** : [SPHINX](#)
- **Recruiter** :
Takahashi Takeo / Takeo.Takahashi@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

We are looking for a serious intern, passionate about mathematics, curious and hardworking. It may be interesting that he has knowledge in physics since the systems that we study are models from physics, as well as bases in computer science (Matlab/Python) to work on the numerical approach of this method of platitude for control.

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.