



Offre n°2024-07495

PhD Position F/M Eco-design of parallel deformable manipulators using plant-based materials

Type de contrat : Fixed-term contract

Niveau de diplôme exigé : Graduate degree or equivalent

Fonction : PhD Position

A propos du centre ou de la direction fonctionnelle

The Inria University of Lille centre, created in 2008, employs 360 people including 305 scientists in 15 research teams. Recognised for its strong involvement in the socio-economic development of the Hauts-De-France region, the Inria University of Lille centre pursues a close relationship with large companies and SMEs. By promoting synergies between researchers and industrialists, Inria participates in the transfer of skills and expertise in digital technologies and provides access to the best European and international research for the benefit of innovation and companies, particularly in the region. For more than 10 years, the Inria University of Lille centre has been located at the heart of Lille's university and scientific ecosystem, as well as at the heart of Frenchtech, with a technology showroom based on Avenue de Bretagne in Lille, on the EuraTechnologies site of economic excellence dedicated to information and communication technologies (ICT).

Contexte et atouts du poste

Context

This thesis is part of the French ANR project PEPR O2R (Flagship project named Organic Robotic, 37.5 Million Euros), more particularly the work-package "Softness and Sustainability" of the Structuring Action 1 (AS1) which questions the environmental impact of robotics and tries to find innovative solutions to lower it.

Objectives

With the current environmental crisis, there is a necessity to reduce the ecological impact of mechatronic systems, such as robotic manipulators. Indeed, these manipulators consist mostly of articulated arms composed of metallic rigid segments. The fabrication of these segments requires the extraction of metallic ore from the earth, energy to refine it in exploitable alloys, the emission of greenhouse gases during their transport, and additional resources to shape the robot link. Fabricating the entirety of part of the links with wood reduces significantly the environmental footprint, as demonstrated in [1], [2]. However, this reduction is limited by the need to use enough wood material and energy to shape it and obtain the desired link rigidity, plant materials being intrinsically flexible. Moreover, the mechanical joints at the articulations still need to use metallic materials. In the Structuring Action 1 of the PEPR O2R project, instead of compensating for the plant material compliance, we propose to exploit it in the design of manipulators with soft and continuum robotics methodologies. The use of materials the least transformed possible, coupled with the absence of joints, will certainly lead to a strong decrease of the environmental footprint. In addition, we propose to investigate the use of parallel continuum structures, composed of several flexible legs controlling an end-effector platform, to reach a level of performance in terms of accuracy and payload for example compatible with applications like co-manipulating a load with an operator

In addition to contributing to answering a big challenge of our society today, and pursuing groundbreaking research in soft robot design by participating in a French Flagship project (PEPR O2R), the PhD candidate will have the opportunity to work with two research teams leaders in robot eco-design and soft robotics, the Armen Team, LS2N in Nantes and the Defrost Team, Inria, in Lille. They will also interact closely with an anthropologist working on evaluating the environmental footprint of robotic manipulators. The PhD student will mainly be based in Lille with several stays in Nantes, with a brut salary of 120k for the 3 years. They will work under the direct supervision of Dr. Sebastien Briot (CNRS, LS2N) and Quentin Peyron (Inria).

Mission confiée

The goal of this PhD is to conduct research on the following questions:

- What raw (or transformed) plant-based materials can be suited for deformable manipulators?

- How to model their sometimes complex mechanical behavior, with its dependency on external factors such as individual variability, humidity, temperature, and aging?
- How to design a parallel deformable manipulator with robust behavior with respect to these variations of properties?
- How to design and fabricate structures with rawplant-based materials ?

Principales activités

Main activities (5 maximum) :

- Reading state-of-the-art papers and writing bibliography reviews
- Designing prototypes and conducting experiments
- Deriving theoretical models based on theory and experiments
- Writing scientific papers and reports
- Presenting the progress and results to the research teams and the scientific community

Additional activities (3 maximum) :

- Participating in the research team and laboratories life
- Attending to and participating in scientific vulgarization events
- Working with undergrad and master interns

Compétences

Technical skills:

- Fundamentals in Robotics
- Fundamentals in continuum mechanics and/or material science
- Training in mechanical design and engineering
- Experiences in prototyping and fabrication

Languages :

- A good level of English, written and spoken, is required

Relational skills :

- Ability to work in a team and will to participate in the research teams' life

Avantages

- 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

Informations générales

- **Thème/Domaine** : Robotics and Smart environments
Instrumentation et expérimentation (BAP C)
- **Ville** : Villeneuve d'Ascq
- **Centre Inria** : [Centre Inria de l'Université de Lille](#)
- **Date de prise de fonction souhaitée** : 2024-10-01
- **Durée de contrat** : 3 years
- **Date limite pour postuler** : 2024-06-08

Contacts

- **Équipe Inria** : [DEFROST](#)
- **Directeur de thèse** :
Peyron Quentin / quentin.peyron@inria.fr

A propos d'Inria

Inria est l'institut national de recherche dédié aux sciences et technologies du numérique. Il emploie 2600 personnes. Ses 215 équipes-projets agiles, en général communes avec des partenaires académiques, impliquent plus de 3900 scientifiques pour relever les défis du numérique, souvent à l'interface d'autres disciplines. L'institut fait appel à de nombreux talents dans plus d'une quarantaine de métiers différents. 900 personnels d'appui à la recherche et à l'innovation contribuent à faire émerger et

grandir des projets scientifiques ou entrepreneuriaux qui impactent le monde. Inria travaille avec de nombreuses entreprises et a accompagné la création de plus de 200 start-up. L'institut s'efforce ainsi de répondre aux enjeux de la transformation numérique de la science, de la société et de l'économie.

L'essentiel pour réussir

- A natural curiosity and appetite for robotics, plant materials, and more generally science
- The will and ability to conduct multi-disciplinary work, in particular at the junction of eco-design, robotics and material science
- A sensibility to and interest in the current ecological problems
- The will to learn the job of a researcher
- A critical but positive mindset

Attention: Les candidatures doivent être déposées en ligne sur le site Inria. Le traitement des candidatures adressées par d'autres canaux n'est pas garanti.

Consignes pour postuler

Please apply with your CV and cover letter.

Sécurité défense :

Ce poste est susceptible d'être affecté dans une zone à régime restrictif (ZRR), telle que définie dans le décret n°2011-1425 relatif à la protection du potentiel scientifique et technique de la nation (PPST). L'autorisation d'accès à une zone est délivrée par le chef d'établissement, après avis ministériel favorable, tel que défini dans l'arrêté du 03 juillet 2012, relatif à la PPST. Un avis ministériel défavorable pour un poste affecté dans une ZRR aurait pour conséquence l'annulation du recrutement.

Politique de recrutement :

Dans le cadre de sa politique diversité, tous les postes Inria sont accessibles aux personnes en situation de handicap.