



Offre n°2025-08916

PhD Position F/M Sensors-based Control of an Aerial Manipulator for Complex Manipulation of Articulated Objects

Type de contrat : Fixed-term contract

Niveau de diplôme exigé : PhD or equivalent

Fonction : Post-Doctoral Research Visit

A propos du centre ou de la direction fonctionnelle

The Inria Centre at Rennes University is one of Inria's eight centres and has more than thirty research teams. The Inria Centre is a major and recognized player in the field of digital sciences. It is at the heart of a rich R&D and innovation ecosystem: highly innovative PMEs, large industrial groups, competitiveness clusters, research and higher education players, laboratories of excellence, technological research institute, etc.

Contexte et atouts du poste

- The work will be carried in English at the Inria Rennes Bretagne Atlantique research center.
- The position is full-time for 1 year. The position will be paid according to the French salary regulations for Post doctoral researchers.
- We do high quality and impactful research in robotics, publishing on the major journals and conferences.
- We often collaborate with other top researchers in europe and worldwide.
- You will have access to a well established laboratory including:
 - two flying arenas equipped with motion tracking system, several quadrotors, and a few fully-actuated manipulators,

- one robotic manipulation lab equipped with several robotic arms, like the Franka Emika Panda.
- You will be part of an international and friendly team. We organize several events, from after works, to multi-day lab retreat.
- Regular visits and talks by internationally known researchers from top research labs.

Mission confiée

Short abstract:

Researchers are trying to make aerial robots perform physical work for new applications like construction, inspection, maintenance, etc. Current methodologies show promising results, but they are limited to very simple tasks only performed in lab environments. In this Thesis we want to go beyond this limited scenario. By the investigation of new sensors-based control methods, we want to make aerial manipulators able to perform much complex tasks using onboard sensors only, especially considering manipulation of articulated objects.

Description:

current investigations and applications are still limited to very simple interaction tasks, involving limited contact behaviors with static and rigid surfaces, and moreover often performed in known/controlled and structured environments (i.e., in ideal lab conditions). Most achieved tasks belong to the family known as push & slide paradigm, which consists in simply touching a wall at different locations with a single point contact end-effector while controlling the interaction force [1, 2]. Moreover, most works performed such a task in indoor controlled environments where the robot position is measured with accurate motion capture systems (MOCAPs) and the environment is perfectly known [3].

This project aims at pioneering this still mostly unexplored domain, pushing further the boundaries of Aerial Physical Interaction (APhI). In contrast to the current state of the art, our goal is to enhance aerial robotic physical interaction capabilities of highly dynamical aerial manipulators (AMs) by considering almost unexplored directions:

- manipulations tasks of articulated and dynamic objects;
- real scenarios requiring the use of onboard sensors only.

The project will focus on the design of sensor-based control algorithms to make aerial robots much more precise, robust and safe while performing physical interaction tasks involving articulated objects, in real environments. As a final demonstrator we want to show an aerial robot equipped with an articulated arm capable to open a door with onboard sensors only.

Principales activités

The project will address the following points:

- **Reactive manipulation planner:** Develop a reactive manipulation planner which makes the robot able to perform complex manipulation tasks while quickly reacting to external disturbances and unexpected events (like wind or loss of contact). For this we will rely on fast re-planning concepts similar to MPC methods and Model Predictive Path-Integral Control (MPPI) [4].
- **Sensors-based manipulation planner:** Integrate a sensing framework such that the system will rely on onboard sensors only. We also want to formally consider the constraints imposed by the sensing framework in the motion planning problem.
- **Robust manipulation planner:** Improve the manipulation planner such that it generates motions that are intrinsically robust to model uncertainties. For this we will rely on the concept of sensitivity, as well as on deep reinforcement learning methods..
- **Experimental validation:** All previous tasks will be validated with real experiments. As a final demonstrator we want to show an aerial robot equipped with an articulated arm capable to manipulate articulated objects, e.g., open a door, using onboard sensors only.

Avantages

- Subsidized meals
- Partial reimbursement of public transport costs
- Possibility of teleworking (90 days per year) and flexible organization of working hours
- Partial payment of insurance costs

Rémunération

Monthly gross salary amounting to 2200 euros

Informations générales

- **Thème/Domaine :** Robotics and Smart environments
Instrumentation et expérimentation (BAP C)
- **Ville :** Rennes
- **Centre Inria :** [Centre Inria de l'Université de Rennes](#)
- **Date de prise de fonction souhaitée :** 2025-09-01
- **Durée de contrat :** 12 months
- **Date limite pour postuler :** 2025-07-15

Contacts

- **Équipe Inria :** [RAINBOW](#)

- **Recruteur :**
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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

- PhD degree in mechatronics, robotics, engineering, computer science (or related fields)
- Excellent publication records
- Excellent written and spoken English skills
- Good experience in C/C++ , ROS, Matlab/Simulink, CAD
- Good experience with numerical trajectory optimization tools for robotics (e.g., use of CaSaDi, Acado, Autodiff, Crocoddyl, etc.)
- Scientific curiosity, large autonomy and ability to work independently
- Experience with robotic systems and/or aerial robots is a plus

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 submit online : your resume, cover letter and letters of recommendation eventually

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.