



Offer #2024-07388

Doctorant F/H Development of Accurate Control Models for Tendon-Actuated Continuum Robots in Endoscopic Surgery

The offer description below is in French

Contract type : Fixed-term contract

Level of qualifications required : Graduate degree or equivalent

Fonction : PhD Position

Assignment

Job Offer: PhD Position in Robotics for Minimally Invasive Surgery

Project Title: Development of Accurate Control Models for Tendon-Actuated Continuum Robots in Endoscopic Surgery

Context: Continuum robots have emerged as revolutionary tools in Minimally Invasive Surgery due to their unique ability to navigate through small incisions or openings, offering flexible and curved access to intricate anatomical structures within the body. Tendon-actuated robots, in particular, are commonly employed in surgical settings, offering precise manipulation within the surgical environment. However, achieving precise control of these robots presents significant challenges, primarily due to their deformable nature and complex interactions with anatomical structures.

Objectives: This project aims to develop accurate control models capable of capturing the nonlinear behavior of tendon-actuated continuum robots, especially when navigating through endoscope working channels. By incorporating realistic nonlinear Finite Element (FE) models into the robot's control system, the project seeks to address factors such as friction, interactions with the channel, and environmental effects. The primary application of this research focuses on enhancing Endoscopic Submucosal Dissection (ESD) procedures by automating specific tasks, thus reducing the surgeon's workload.

Relation to the State of the Art: Traditionally, models for continuum robots have progressed from simplistic geometric assumptions to more intricate mechanics-based frameworks. Despite advancements, accurately representing interactions such as friction and contact remains a challenge. This project aims to bridge this gap by integrating advanced numerical models and interaction models to manage factors crucial for addressing challenges in surgical robotics.

Methodology and Planned Timetable: The project methodology involves several critical aspects, including modeling continuum robots, addressing nonlinear phenomena in robot control, and exploring advanced control strategies. The planned timetable spans over three years, with the first year dedicated to modeling the endoscope and investigating Cosserat formulation. The second year will focus on using the model in iFE simulation, defining constraint objectives linked to clinical tasks. The third year will involve experiments and parameterization.

Job Details:

- Position: PhD Researcher
- Duration: 3 years, starting in September
- Location: Strasbourg
- Responsibilities: Conduct research, develop control models, perform simulations, collaborate with interdisciplinary teams, publish findings in peer-reviewed journals, and contribute to project milestones.
- Qualifications: Master's degree in Robotics, Mechanical Engineering, or related field, strong background in control theory, robotics, and simulation techniques, proficiency in programming languages such as C/C++. excellent communication and teamwork skills.

How to Apply: Please submit your CV, cover letter outlining your research interests and relevant experience, academic transcripts, and contact information for two referees to hcourtecuisse@unistra.fr. Application deadline: 01/05/2024.

Join us in this exciting opportunity to advance the field of robotic surgery and make a meaningful impact on patient care. We look forward to welcoming a motivated and talented individual to our team.

Main activities

To achieve greater autonomy in robotic control, it is crucial to develop accurate control models capable of capturing the nonlinear behavior of continuum robots, especially when navigating through endoscope working channels. Additionally, simulating the environment will also play an important role in achieving this goal. By incorporating realistic nonlinear Finite Element (FE) models into the robot's control system, this PhD aims to effectively address nonlinear factors such as friction, interactions with the channel, and environmental effects. The primary application of our project focuses on Endoscopic Submucosal Dissection (ESD). For instance, the goal could be to automate the arm responsible for grasping the tumor during the procedure. This could help maintain the position of the grasped structure, thereby reducing the surgeon's

workload for manipulating the second arm.

Skills

Compétences techniques et niveau requis :

Langues :

Compétences relationnelles :

Compétences additionnelles appréciées :

Benefits package

- Restauration subventionnée
- Transports publics remboursés partiellement
- Congés: 7 semaines de congés annuels + 10 jours de RTT (base temps plein) + possibilité d'autorisations d'absence exceptionnelle (ex : enfants malades, déménagement)
- Possibilité de télétravail (après 6 mois d'ancienneté) et aménagement du temps de travail
- Équipements professionnels à disposition (visioconférence, prêts de matériels informatiques, etc.)
- Prestations sociales, culturelles et sportives (Association de gestion des œuvres sociales d'Inria)
- Accès à la formation professionnelle
- Sécurité sociale

Remuneration

2100 € gross/month the 1st year

General Information

- **Theme/Domain** : Computational Biology
Biologie et santé, Sciences de la vie et de la terre (BAP A)
- **Town/city** : Strasbourg
- **Inria Center** : [Centre Inria de l'Université de Lorraine](#)
- **Starting date** : 2024-10-01
- **Duration of contract** : 3 years
- **Deadline to apply** : 2024-05-01

Contacts

- **Inria Team** : [MIMESIS](#)
- **PhD Supervisor** :
Courtecuisse Hadrien / Hadrien.Courtecuisse@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

Vous pouvez donner là, un portrait à "gros traits" du (de la) collaborateur(trice) attendu(e) : ce que vous voyez comme nécessaire et suffisant et qui peut associer :

- goûts et appétences,
- domaine d'excellence,
- éléments de personnalité ou de caractère,
- savoir et savoir faire transversaux...

Cette rubrique permet de compléter et alléger (réduire) la liste plus formelle des compétences :

- "Se sentir à l'aise dans un environnement de dynamique scientifique, aimer apprendre et écouter sont des qualités essentielles pour réussir cette mission."
- "Passionné(e) par l'innovation, avec une expertise dans le développement Ruby on Rail et une grande capacité de conviction. Une thèse dans le domaine *** constitue un réel atout."

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.