



**Offer #2023-06293**

## **Post-Doctoral Research Visit F/M Postdoctoral Offer: Shared control and skill transfer in haptic teleoperation**

**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 center at the University of Bordeaux is one of the nine Inria centers in France and has about twenty 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 SMEs, large industrial groups, competitiveness clusters, research and higher education players, laboratories of excellence, technological research institute...

### **Context**

Every year Inria International Relations Department has a few postdoctoral positions in order to support Inria international collaborations. This year, postdoctoral positions within the frame of Inria London, Inria Brasil and Inria Chile programs and to strengthen partnerships with Simula (Norway), University of Waterloo (Canada) and KAIST and ETRI (South Korea) are eligible

A postdoctoral position is opened through the Inria International Relations Department (DRI) campaign within the Inria-KAIST partnership. This position is part of a joint project initiated between the [AUCTUS](#) team at Inria and the [IriS](#) lab at KAIST, about shared control and skill transfer in haptic teleoperation.

Being one of the nine Inria center, the Inria center of the University of Bordeaux is a public scientific institute located in Talence (France). It gathers together about twenty research teams in digital sciences, computer sciences, mathematics, robotics, and machine learning, with different academic and industrial partners.

KAIST, also known as the Korea Advanced Institute of Science and Technology, is a public research university located in Daejeon, South Korea. It is considered one of the top universities in Korea and is renowned for its excellence in science, engineering, and technology. The research areas at KAIST cover a wide range of fields, including physics, chemistry, materials science, engineering, computer science, and biology. The university has a particular strength in artificial intelligence and robotics, with world-class research teams in these areas. Additionally, KAIST has established itself as a leader in entrepreneurship and technology commercialization, with numerous startups and spin-off companies emerging from its research programs

The AUCTUS team aims at improving assistive systems and collaborative robots for humans at work. The team particularly focuses on the analysis and modeling of human behavior to adapt robot assistance; on the optimization of human-robot coupling in terms of performances and interaction; and on the design of assistive robots, which covers the choice of the robot architecture, the dimensional design, the task description, and the human-robot interface and robot control.

The IriS (Interactive Robotic Systems) Lab at KAIST is a cutting-edge research laboratory focused on developing theoretical principles and advanced technologies in the field of interactive robotic systems. The lab research interests include haptic control to enhance stability, transparency, and intuitiveness in telerobotics; the design of soft and flexible actuators and wearable devices for more comfortable and adaptable assistance; soft growing robots, which are designed to be highly adaptable and able to navigate complex environments; autonomous vehicles.

### **Assignment**

The postdoc contract will have a duration of 24 months. The default start date is November 1st, 2023 and not later than January, 1st 2024.

The postdoctoral fellow will be recruited at the Inria center of the University of Bordeaux (AUCTUS team), where he/she will start the research project. Two six-month exchange periods will be planned at KAIST (IriS lab) to share the works and progresses.

Candidates for postdoctoral positions are recruited after the end of their Ph.D. or after a first post-doctoral period: for the candidates who obtained their PhD in the Northern hemisphere, the date of the Ph.D. defense shall be later than 1 September 2021; in the Southern hemisphere, later than 1 April 2021.

In order to encourage mobility, the postdoctoral position must take place in a scientific environment that is truly different from the one of the Ph.D. (and, if applicable, from the position held since the Ph.D.); particular attention is thus paid to French or international candidates who obtained their doctorate abroad.

Lab contacts:

Margot Vulliez (Inria) [margot.vulliez@inria.fr](mailto:margot.vulliez@inria.fr) and Jee-Hwan Ryu (KAIST) [jhryu@kaist.ac.kr](mailto:jhryu@kaist.ac.kr)

## Main activities

Haptic teleoperation is a promising method to enable Humans and robots to jointly perform an activity. The human operator can remotely control the robot while receiving feedback on the task interaction. Such remote interaction is particularly beneficial in confined, unsafe, or sensitive environments such as hazardous sites, underwater or space. It naturally combines human high-level intelligence and robot physical capabilities while maintaining the safety and comfort required for the Human. Unfortunately, conventional teleoperation methods do not leverage the robot assistance and collaborative ability to its fullest, since the operator usually fully controls the remote task, with a high mental workload and poor performances.

Recent shared-autonomy concepts have been proposed in the literature to transfer part of the task from the human operator to the robotic agent. These approaches range from complementary and predefined subtask allocations to adaptive shared-control methods. Focusing on this second and more flexible paradigm, the postdoctoral project aims at improving shared control in haptic teleoperation, to make the robot gain responsibility on the task, adapt its behavior with respect to the human intent, and ultimately act as an effective collaborator.

According to their background and preferences, the postdoctoral scholar will direct the research works to tackle the two following key challenges:

1. Generating robust haptic guidance from generic robot skills (robot control primitives). An important research corpus has shown that adding active constraints to the haptic feedback can either guide the operator toward an optimal gesture during the remote task execution, or convey robot-related or contextual information. However, haptic guidance is commonly based on geometric or motion-related virtual fixtures, highly sensitive to the environment uncertainties. We will build upon robust robot control primitives to generate adaptive and generic haptic guidance. By locally exploiting the robot skills and autonomy, controlling its behavior through sensory-based force-motion task primitives, the guidance can directly feedback the robot adaptive behavior, robust to the environment changes. We will particularly focus on maintaining a safe and stable interaction with this new concept of skill-based adaptive haptic guidance.

2. Online skill transfer during teleoperation. Assisting Humans in their activity requires the robot to master elementary gestures or actions, and to accurately control physical interactions with the environment. Despite their sensorimotor ability, robots lack of functional autonomy. This second activity aims at increasing robot manipulation skills by taking advantage of their rich multisensory data available during a task performed by the human expert in haptic teleoperation. The first issue will be to transfer new skills to the robot during the teleoperation from the collected data. It can be either done through segmentation and parameterization methods, to extract basic force-motion patterns and encode new task primitives, or through an online learning by demonstration. We will pay a particular attention to ensure robustness of the new robot skills, through distribution-based task descriptions (Gaussian Mixture Models, Locally Weighted Regression, Hidden Markov Models, etc.).

## Skills

The candidate should have graduated with a PhD in robotics.

He/she should have solid skills in robotic control, programming (C++, Python), and kinematic/dynamic modeling. Their past works should demonstrate a proper balance between fundamental works and experimental studies.

Any additional experience in haptics, telerobotics, planning, or machine learning would be appreciated.

## 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 partial 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

## Remuneration

gross monthly remuneration (before salary charges and taxes): 2746 euros

## General Information

- **Theme/Domain** : Robotics and Smart environments  
Instrumentation et expérimentation (BAP C)
- **Town/city** : Talence
- **Inria Center** : [Centre Inria de l'université de Bordeaux](#)
- **Starting date** : 2023-11-01
- **Duration of contract** : 2 years
- **Deadline to apply** : 2023-06-18

## Contacts

- **Inria Team** : [AUCTUS](#)
- **Recruiter** :  
Vulliez Margot / [margot.vulliez@inria.fr](mailto:margot.vulliez@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.

**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 for this Inria postdoc are submitted on line and must include:

- A detailed CV with a description of the PhD and a complete list of publications with the two most significant ones highlighted.
- A motivation letter with a description of the candidate interests and planned methodology to tackle the research project.
- Two letters of recommendations.
- A passport copy.

### 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.