



Offer #2022-05169

PhD Position F/M Modeling Kinesthetic and Tactile Properties of Virtual Environments

Contract type : Fixed-term contract

Level of qualifications required : Graduate degree or equivalent

Other valued qualifications : Master in Virtual Reality, Computer Graphics or Haptics

Fonction : PhD Position

Level of experience : Recently graduated

About the research centre or Inria department

The Inria Rennes - Bretagne Atlantique Centre is one of Inria's eight centres and has more than thirty research teams. The Inria Center 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 PME's, large industrial groups, competitiveness clusters, research and higher education players, laboratories of excellence, technological research institute, etc.

Context

The PhD candidate will join the NEMO.AI laboratory, a joint laboratory dedicated to research and applications in Virtual Reality in the context of the Metaverse, gathering Inria and Interdigital company.

Assignment

The democratization of virtual reality has strongly re-invigorated the research on haptic devices for enriching virtual reality experiences. However, the wide range of available haptic devices raises the need of providing standardized methods to encode and decode haptic signals, and author haptic experiences [Danieau 2012, Danieau 2018, Li 2021]. While, kinesthetic feedback is strongly coupled with the physical simulation underneath, tactile rendering is mainly defined by ad-hoc authoring processes. For example, as for today, there is no obvious, generalized way to provide haptic properties to a virtual object, and most haptic rendering setups rely on custom and specific data formats. Even "holistic" systems [Kammermeier 2004][Yang 2005][Drif 2008], aiming at an exhaustive combination of haptic actuators, did not clearly address the question of holistic haptic data. This lack of standard representation impedes the whole computer haptics pipeline, from acquisition to rendering. A common, standardized way of defining haptic data would help to unify the approaches, simplifying the authoring and ensuring interoperability. Furthermore, in the context of immersive virtual reality haptic rendering is strongly coupled with the users' actions and capabilities, which has been rarely addressed.

Main activities

The goal of this PhD is to propose a complete haptics pipeline that is agnostic on the haptic device used and integrate not only the definition of the haptic properties, but also the interaction characteristics of the user. The rendering of the haptic properties should not only be driven by the virtual object properties, but also by the actions of the user in the virtual environment [Vizcay 2021]. Thus, the interaction capabilities of the user should be taken into account [Dewez 2021]. In particular, avatars, the users' virtual representation, is becoming ubiquitous in virtual reality applications. In this context, the avatar becomes the medium which enables users to interact with the virtual environment and also the main source of tactile and kinesthetic sensations. Moreover, the user's avatar can modulate the perceived haptic sensations [Jauregui 2014], enabling a wider range of sensations than the ones provided solely by haptic actuators. Finally, haptic sensations should be congruent with the actual user's actions in order to avoid the potential generation of an uncanny valley [Berger 2018], which is strongly linked with the notions of presence [Skarbez 2017] and virtual embodiment [Kiltney 2012].

Objectives

The main tasks conducted in this PhD will be:

1. Study the state of the art of haptic authoring and virtual environment definition.
2. Propose novel methods to encode and decode haptic properties of the virtual environment, taking into account, not only the authoring of the haptic properties but also the interaction capabilities of the user.
3. Develop a number of proof of concepts to showcase the proposed methods.

4. Conduct user evaluations to ensure the viability of the proposed methods.

Skills

- Experience in Virtual Reality, Computer Graphics or Haptics
- Experience on Unity/C#
- Fluent in English (reading, writing, and speaking)

Benefits package

- 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

Remuneration

Monthly gross salary amounting to 2051 euros for the first and second years and 2158 euros for the third year

General Information

- **Theme/Domain** : Interaction and visualization
Software Experimental platforms (BAP E)
- **Town/city** : Rennes
- **Inria Center** : [Centre Inria de l'Université de Rennes](#)
- **Starting date** : 2023-09-01
- **Duration of contract** : 3 years
- **Deadline to apply** : 2023-05-31

Contacts

- **Inria Team** : [HYBRID](#)
- **PhD Supervisor** :
Argelaguet Sanz Fernando / ferran.argelaguet@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

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

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.