



**Offer #2020-02994**

## **Post-Doctoral Research Visit F/M Musculoskeletal modeling and machine learning to quantify the biomechanical activity of manual wheelchair users**

**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 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 PMEs, large industrial groups, competitiveness clusters, research and higher education players, laboratories of excellence, technological research institute, etc

### **Context**

The MimeTIC research team and the INI-CERAH are hiring a postdoctoral fellow for 24 month with a mobility between two labs (12 months at MimeTIC research team, Rennes, France, followed by 12 months at CERAH, Créteil, France), on the topic of the quantification of the biomechanical demand associated to wheelchair locomotion in various daily situations.

Locomotion with a manual wheelchair (MWC) generates an important stress on the upper limbs of manual wheelchair users (MWU), that varies according to the environment. To assist MWU to choose the path that best preserve their upper limbs, a cost based on the biomechanical demand of the successive situations along the possible paths must be attributed. In the current accessibility standards, obstacles have no graduation and are only marked as crossable or not. This reflects neither the variety of the situations, nor the link between accessibility and physical or technical abilities of the MWU. To go beyond these limitations, this project aims at defining biomechanical costs attributed to various environmental situations and implementing them in optimal path selection algorithms. This would provide individualized paths to MWU considering their own capacities. To do so, a musculoskeletal model will be developed to quantify biomechanical costs. These costs will be computed for various situations, reproduced in a realistic MWC locomotion simulator developed in the framework of this proposal. Such a project will provide original and useful data for accessibility evaluation, urban development planning and MWC assistance adaptation. It will be the basis for further MWU evaluation and paths characterization to provide personalized cost-optimal paths.

The project CapaCITIES, granted by the French National Research Agency (ANR), is a collaborative project involving the:

- Centre d'Etudes et de Recherche sur l'Appareillage des Handicapés (CERAH, Institution Nationale des Invalides)
- MimeTIC Team (IRISA/M2S/INRIA joint team, Rennes France)
- Institut de Biomécanique Humaine Georges Charpak (IBHGC, Arts et Métiers Sciences et Technologies)
- Laboratoire d'Automatique, de Mécanique et d'informatique industrielle et humaine (LAMIH, Université Polytechnique des Hauts de France)

### **Assignment**

The post-doctoral fellow will be involved in personalized musculoskeletal modeling and simulation, experiments, and data preparation to provide the biomechanical costs of WCH locomotion.

### **Main activities**

First, he/she will be involved in the development of a comprehensive musculoskeletal model of the upper limb and its interaction with a wheelchair, in collaboration with a PhD student already hired on the project. The postdoctoral fellow will have to implement specific interaction rules between the user and the wheelchair inside such simulations, involving contact representation and detection as well as interaction forces prediction.

Second, he/she will be involved in the model scaling issues relative to the model proposed above. For the scaling of the user muscle capacities in specific configurations, he/she will develop specific data-based

scaling methods.

Third, he/she will focus on the data mining of experimental data gathered along the project (he/she will also be involved in these experimentations), to be applied to the model developed above. From the parameters computed with this model, the postdoctoral fellow will develop automatic extraction methods of features of interest able to characterize the wheelchair locomotion task with regard to the conditions. This work will be a fundamental part of the development of an aggregative biomechanical score representative of the wheelchair locomotion for many situations.

## Skills

The candidates ideally have a significant experience in musculoskeletal modeling, and a certified background in machine learning. A strong experience in biomechanical data processing and experimentations is also relevant for this work. Fluent english is required.

## Benefits package

- Subsidized meals
- Partial reimbursement of public transport costs

## Remuneration

Rémunération mensuelle brute de 2653 euros

## General Information

- **Theme/Domain** : Modeling and Control for Life Sciences  
Biologie et santé, Sciences de la vie et de la terre (BAP A)
- **Town/city** : Rennes
- **Inria Center** : [Centre Inria de l'Université de Rennes](#)
- **Starting date** : 2021-01-01
- **Duration of contract** : 2 years
- **Deadline to apply** : 2020-10-31

## Contacts

- **Inria Team** : [MIMETIC](#)
- **Recruiter** :  
Pontonnier Charles / [Charles.Pontonnier@irisa.fr](mailto:Charles.Pontonnier@irisa.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

Teamwork and supervision experiences may be a plus for this highly cooperative project.

**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.

