



## Center for Biomedical and Healthcare Engineering SAINBIOSE Laboratory

### Post-doctoral position in « Numerical modeling of the mechanical effect of a compression device on the leg »

The École Nationale Supérieure des Mines de Saint-Étienne (Mines Saint-Etienne), a school of the Institut Mines Télécom (IMT), under the supervision of the Ministry of the Economy and Finance, is responsible for training, research and innovation, transfer to industry and scientific, technical and industrial culture. Mines Saint-Etienne represents: 2,400 student-engineers and researchers in training, 400 staff, a consolidated budget of 46 M€, 3 sites on the Saint-Etienne campus (Loire) of approximately 26,000 m<sup>2</sup>, a Georges Charpak Provence campus in Gardanne (Bouches-du-Rhône) of approximately 20,000 m<sup>2</sup>, 6 research units, 5 training and research centers, and a center for scientific, technical and industrial culture (La Rotonde) Mines Saint-Etienne has development projects in Lyon, notably on the Digital Campus of the Auvergne-Rhône-Alpes region, and numerous international collaborations.

**Keywords:** Numerical simulation, textile/skin interactions, biomechanics

**Academic Context:** The post-doctoral fellow will join the STBio team, from the Centre Ingénierie et Santé (Mines Saint-Etienne) and the SaInBioSE laboratory (INSERM U1059), whose research activities are focused on soft tissue biomechanics. For several years, STBio has been working on the interactions between medical textile devices and the skin, in order to better understand their mechanisms of action and/or to prevent certain complications.

**Background:** The device under study is a very innovative system developed for the treatment of lymphedema. It consists of a compressive envelope with a structured inner face. Although several clinical investigations have shown its efficiency, its mechanism of action remains poorly understood. It is based on the interface pressure, but also on its spatial and temporal variation, that is exerted on the surface of the skin. The geometrical structure of the inner face determines these pressure variations.

#### 1/ Profile of the candidate

PhD in Mechanics, Mechanical Engineering or Biomechanics within the last 3 years, motivated by the development of patient-specific numerical simulations and their clinical applications.

#### 2/ Missions

Based on previous work, the objective of this project is to model the mechanical effect of this compression device on the leg (interface pressure, effect on the lymphatic channels) to understand the mechanisms of action of the device and to be able to optimize them.

To do so, the project will focus on factors directly related to the device itself (overall mechanical behavior, geometry, in particular the size of the foam pads of the inner structure), or related to the morphology of the patient. It will also focus on the mechanical behavior at the skin-device interface.

The first step will be the creation of an anatomical digital twin (internal and external) of a leg of a patient suffering from lymphedema. Then a model of the application of the device on the leg will be developed, in order to obtain the pressures applied on the skin, but also on the lymphatic channels. Finally, the sensitivity of the different parameters on the applied pressure (and its temporal and spatial variations), as well as on the hydrostatic pressure and shear generated at the level of the lymphatic channels, will be studied via a meta-model.

This project will provide new knowledge on the lymphatic circulation of the limbs, which will lead to significant improvements in patient care devices and protocols.

This project will be carried out in close collaboration with Thuasne's R&D teams.

### **3/ Recruitment conditions**

1-year-fixed-term contract under public law, full time

Remuneration according to the rules defined by the Institut Mines Télécom's management framework.

Based in **Saint-Etienne (42)**

Desired start date : **October, 1th 2022**

### **4/ Application procedures**

Applications (covering letter, detailed curriculum vitae and any other element deemed useful for the examination of the application) must be submitted by **July, 13<sup>th</sup>, 2022 at the latest** on the RECRUITEE platform :

<https://institutminestelem.com/recrutee.com/o/postdoctorante-postdoctorant-modelisation-numerique-de-leffet-mecanique-dun-dispositif-de-compression-sur-la-jambe>

### **5/ For more information**

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