# PhD position – EMSE 2018

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| PhD title | **Friction mechanism effects on medical device/human body interaction** |
| Host laboratory | SaInBioSE INSERM U1059 |
| Clinical partner | MPR, CHU Saint-Etienne |
| Industrial partner | Thuasne |
| Themes | Engineering & Health |
| Scientific domains | Engineering sciences (DS8) |
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**PhD subject**

Auvergne-Rhone-Alpes is the first European supplier of textile-based medical devices for compression or contention (knee braces, lumbar belts, compression socks …). Local medical-textile device industries, physicians of the Saint-Etienne University Hospital (PM&R service) and engineers of Mines Saint-Etienne work together at their optimization.

These devices have multiple effects, but the principal claim is a mechanical action: the pressure applied on the body induces a change in the mechanical and therefore physiological equilibrium. Even if the efficiency of this type of medical devices is well established, the mode of action is still badly understood. Recent experimental developments showed a significant discrepancy between the measured pressure and the expected one, demonstrating that the basic compression mechanism, described by the Laplace Law needs to be revised. Concurrently, some patients develop skin intolerance to the pressure, which tends to affect their compliance to the medical prescription.

Therefore, Mines Saint-Etienne, Saint-Etienne University Hospital and LTDS joined their forces to develop the TolSkin project which aims at determining the conditions for the emergence of cutaneous intolerance (1) by a clinical study using innovative experimental methods and (2) by developing a mecanobiological model that reproduces the mechanical and biological phenomena occurring at the skin-textile interface.

In the framework of this project, the PhD student will take over skin-textile contact modeling, considering a low calculation time, and including a mecanobiological model from the literature. A mechanical set-up will reproduce the skin-textile interaction to validate the model. A first pilot study will be led to establish risk factors of intolerance in conditions specified by our industrial partner.

The PhD student will also work on the clinical study. He will be in charge of the experimental protocol. In particular, he will coordinate the existing experimental devices and new ones, both necessary to collect the data describing the mechanical state of the skin nearby or beneath the medical device. He will work together with a post-doc student and under the supervision of the medical staff the University Hospital.

« Soft Tissue Biomechanics » is a transverse team of SaInBioSE laboratory composed of 26 people (10 permanent staff). It is located on the Health & Innovations Campus, close to the University Hospital. The research program « TexMed2k », which includes this project, gathers 3 permanent researchers and 2 PhD students and will host an industrial chair in 2018. Tolskin project is a funded by Auvergne Rhône Alpes Region.

**Keywords**

Biomechanics, tribology, medical textiles, contention

**Candidate profile**

Ability to work cooperatively in an interdisciplinary group.

A desire to bring new understanding to medical problems.

Sound knowledge in mechanics (analytical, numerical and experimental).

Proficiency in English language.

**Recruitment procedure**

CV and motivation letter reception before the Feb. 15, 2018 (included).

Selection phase from applications finalized on May 1$^{st}$, 2018.

Interviews and comparative evaluations of selected candidates before March 15$^{th}$, 2018.

Selection committee: human resources director, CIS director, PhD director and supervisors.