PhD. project (ED SPIM, UBFC)

Biomechanics of the Human Skin from In Vivo Extension tests

**FEMTO-ST Institute:**
Located in Besançon, France, FEMTO-ST Institute is a highly stimulating environment where cutting edge researches in complementary disciplines of engineering sciences are developed for more than 20 years. The different fields of expertise cover diverse domains of application with the realization of advanced demonstrators and fully operational systems. The development of miniaturized biomedical instrumentation and devices able to characterize patient-specific parameters necessary to clinical practice is one of our priorities as well as one of our internationally acknowledged fields of expertise.

**Biomedical needs:**
The human skin is a smart material of which mechanical properties vary significantly versus people, age, body zones and pathologies. The knowledge of its mechanical properties is nevertheless a key-parameter to optimize wound healing consecutive to surgical acts. The forces involved in closing surgical openings must indeed respect the local elastic capabilities of the patient's skin to allow normal physiological functioning and tissue recovery. Because of the variability observed in the human skin mechanical properties, patient's specific measurements on the body zone concerned have to be performed to best plane surgical acts. There is therefore a strong need for a dedicated instrumentation suited to any body-zone, non-invasive and able to characterize the human skin behaviour accurately and objectively.

**Expertise and Project:**
Our team has about ten years of experience in the development of human skin extensometers in close collaboration with biologists and surgeons. A successful apparatus is depicted in Fig. 1 that performs 1D extension tests whereas the collected data allow the modelisation of the skin behaviour and thus to predict the skin extension capabilities. The PhD project consists in developing a new generation of extensometer with, as major features, a centimetre size of interaction (instead of 40 cm²) and to get free from the necessity to stick the device on the skin. The expected results are to obtain instant measurements without skin preparation on all body zones and thus to fulfil the most demanding surgeon's expectations. Works will be carried out in collaboration with Biotika, the Junior Enterprise of ISIFC Biomedical Engineer School.

**Works to be performed:**
With the assistance of specialists of different fields, biologists and surgeons included, the work will contribute to the realization of a new skin extensometer, from its conception to its experimental validation on human skin in vivo, including experimental data processing and numerical modelling (the new concept is not detailed at this stage for intellectual property reasons). Scientific results will be published in internationally referenced journals.

**Required qualifications**
Candidates will have a strong determination in implementing the most appropriate technologies in due time and the capability to look for necessary skills and competences in diverse fields of engineering sciences. Experience in the realization of a demonstrator and/or numerical modelling will be appreciated.

**Information and applications:**

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**Fig. 1:** Operational human skin extensometer in vivo