DOCTORAL THESIS IN ROBOTICS

Sensing the continuum robot's interaction to the environment

PhD open position within the doctoral network "Soft Active Matter Microrobots for Medicine (SAM3)", funded by EU HORIZON-MSCA-2025-DN-01-01 # 101312674

Collaboration Prof Kanty RABENOROSOA (UMLP, Besançon, France), Prof Guillaume BESCH (CHUB, Besançon, France), Prof Jérémy ODENT (UMONS, Mons, Belgium), Dr Johann ANGUENOT (Statice, Besançon, France)

Research project on Sensing the continuum robot's interaction to the environment (SAM3/ESR8 - continuum)

This project takes place within the Marie Curie Doctoral Network on Soft Active Matter Microrobots for Medicine (SAM3). This doctoral network of 12 PhD candidates aims at exploring the ear-nose-throat area from a microrobotics perspective. Thanks to active matter and small scale microrobotics engineering, three specific goals are targeted: (1) access the middle ear through the Eustachian tube; (2) access the olfactory clefts for mucosal biopsy; (3) access the skull cavity through the nose and the cribble plate for cerebrospinal fluid biopsy.

This specific PhD proposal on Sensing the continuum robot's interaction to the environment is part of the first endoscopic area namely the middle ear. The goal of the PhD is to develop distributed sensing and proprioception along the microrobot's backbone and tip force sensing to address the requirements for the upper part of nasal cavity biopsy and middle ear intervention. The technology will provide control of the interaction of the soft robot to the environment (fragile anatomy).

The expected results are further set as follows: **1) Fabrication process** of distributed sensing and tip force sensing at the fiber's diameter footprint. **2) Embedded sensing** on sub-mm soft robot able to sense environment interaction. **3) Experimental validation** of the entire proposed sensing system

The candidate will be enrolled as PhD student at UMLP (Besançon, France), in the Doctoral Degree in Robotics, Doctoral school SPIM, UMLP. A co-supervision is planned with Prof Hugo DAGUERRE (UMLP, Besançon, France).

An clinical stay of 1 month is planned at CHUB (Prof Guillaume BESCH, Besançon, France) for discovering ENT surgeries with the RoBOtol and clinical research on technologies, an academic stay of 4 months is planned at UMONS (Prof Jérémy ODENT, UMONS, Mons, Belgium) for miniaturization of sensory electromechanical materials and an industrial stay of 3 months is planned at Statice (Dr Johann ANGUENOT, Besançon, France) for Validation for nasal cavity exploration.

Research environment

The main research lab will be the FEMTO-ST lab of the UMLP - Université Marie et Louis Pasteur (UMLP, Campus La Bouloie, Besançon, France).

The PhD student will be supervised by Prof Kanty RABENOROSOA (UMLP,Besançon, France) and co-supervised by Prof. Hugo DAGUERRE (UMLP, Besançon, France).

Both supervisors of this project have complementary expertise towards the goals of this PhD: design and modeling continuum microrobots, microfabrication and experimental characterization.

More information on the supervisors:

- Prof Kanty RABENOROSOA https://sites.google.com/view/rkanty/, full Professor (section 61) at Université Marie et Louis Pasteur with the Automatic Control and Micro-Mechatronic Systems (AS2M) department of FEMTO-ST Institute. His research interests include mechatronics, smart actuator, soft and continuum microrobotics for medical applications.
- Prof Hugo DAGUERRE, is an Assistant Professor at Université Marie et Louis Pasteur and carries out his research with FEMTO-ST Institute and other international institutions (e.g., guest researcher at the University of Twente from October to December 2023). His research interests include microrobotics, microfluidics, and autonomous devices for biomedical applications.

The department FEMTO-ST Institute/AS2M Department belongs to the Université Marie et Louis Pasteur (Besançon, France) and operates the microfabrication platform https://platforms.femto-st.fr/centrale-technologie-mimento/en, equipped with all necessary facilities for manufacturing and characterization at the small scale.

For the implementation of the project, the candidate will move for 1 month to CHUB (Besançon, France), 4 months to UMONS (Belgium) and 3 months to Statice (Besançon, France).

Job description and profile for SAM3/ESR8

We will appoint 1 PhD student on this project, related to 11 other positions open in the SAM3 EU network.

He/she will be registered within the Doctoral School of Robotics, Doctoral school SPIM, UMLP.

The candidate should have a master degree or diploma in mechanical, mechatronics or robotics engineering, less than 5 years of career at the recruitment date and not having a doctoral degree.

We are seeking talented and enthusiastic students to perform a PhD, with solid background in modelling of multi-physical systems, system design, robotics, soft materials, and manufacturing (micromachining); familiar with Matlab, Python or C++, CAD software and Finite Element Methods

Regarding skills, we look at ability for research management, dissemination, communication with colleagues and supervisors, strong teamwork spirit, creativity, problem solving and attention to safety.

The candidate should have good command of spoken and written English, and French skills are of course an asset.

For more information regarding the PhD studies at the UMLP please check the website https://spim.ubfc.fr/en/

How to apply

Applications should be sent to the mailbox SAM3@umons.ac.be dedicated only to recruitment. They should include: a) a digital copy with all academic certificates and the respective official transcription in English; b) a detailed CV and a motivation letter in English; c) 2 letters of recommendation.

Duration: 3 years full time.
Starting date: Autumn 2026
Deadline for the submission of applications: 31/8/26 though the position will remain open until it is filled