PhD position Project EIPHI GS SmartDigitBot

Job title	PhD Position in Robotics and Automation: modeling, fabrication and control of fibrillar systems for variable adhesion
Job type (PhD, Post-doc, Engineer)	PhD
Contract duration (months)	36 months
Qualifications (Master, Ph.D …)	Master
Job hours (full time/ part time)	Full Time
Employer	UBFC Université Bourgogne Franche-Comté
Financing Institutions	Région Bourgogne Franche-Comté & Graduate School EIPHI
Host Laboratory	FEMTO-ST Institut
URL Host Laboratory	https://www.femto-st.fr/
Address Host Laboratory	26 rue de l'Epitaphe 25000 BESANCON
Job description	Precision manipulation and assembly of micro-objects is an essential step for appliances such as data storage, cell manipulation, etc. The need for a reliable and repeatable micromanipulation operation therefore requires the study of suitable manipulator able to address this issue. However, a micromanipulation operation can be complex due to the involved physical phenomena which are different from those of the mesoscale. The impact of downscaling is commonly referred as the scale effect. The chosen approach in this project consists of developing new grippers able to control the adhesion between the gripper tips and the manipulated object by acting actively on the tips of the gripper using mechanical vibrations. One of the essential elements in this project is the control of the adhesion force to break the contact between two objects, which is called the pull-off force. The first objective requires studying and modeling the interactions between the gripper fingers and micro-objects of various shapes and typical sizes between 1µm and 200µm. We will rely on a rich literature to model and simulate the adhesion forces at microscale to then define the best design of the effector. Models of interaction between micro-objects and gripper fingers are required for the development of reliable micromanipulation strategies and will be developed in this thesis. The second objective concerns the development of methods to optimize the geometry design of the microstructures of the gripper. In this part, we will focus on the development of a generic methodology allowing the integration of optimization criteria to design optimal shapes of these microstructures considering the manufacturing constraints and the mechanical characteristics of the manipulated object. The microstructures will be fabricated using high-resolution 3D additive manufacturing (Nanoscribe 3D printer with IP-PDMS resins). The third objective consists in controlling the adhesion forces between gripper fingers and micro-object, one approach consists of using a dynamically tunable micro-vibration system. The frequency and amplitude parameters of vibration must be precisely studied and controlled in order to be able to develop and optimize physical strategies leading to a precise and reliable micro-manipulation. Recent research has shown that adhesion can be amplified or weakened by controlling microvibrations. In addition, the adhesion force can be maintained at a desired value while ensuring reversibility. This work will study the effects of microvibrations on micro-objects in order to control adhesion forces.
Supervisor(s)	Michaël Gauthier, Wissem Haouas and Kanty Rabenorosoa
Candidate profile	**Requirements (mandatory):** - Successfully completed scientific university degree (Master, Diploma or equivalent) in Robotics, Materials Science, Materials Engineering, Mechanical Engineering or other closely-related discipline with outstanding results, - Experience in material characterization, including optical and electron microscopy, mechanical properties of materials, - Excellent knowledge and experience in robotics and manipulation, - Knowledge of CAD software (such as SolidWorks or Onshape), - Experience in additive manufacturing of materials, - Very good English skills, **Requirements (preferred):** - Experience in computer vision, control and planning are desirable;

	- Ability to lead work independently and work in teams - Experience in finite elements analysis - Experience in composing academic writing pieces (manuscripts, reviews, etc.)
Keywords	Micromanipulation, controllable adhesion, micro-vibration, biomimetics, micropillars, mechanical compliance.
Application deadline	01/06/2022
Application Depending on the type of position	Please send the following documents (all in one PDF file) by e-mail to Wissem HAOUAS (wissem.haouas@femto-st.fr): 1) For EU candidates: Copy of your national ID card or of your passport page where your photo is printed. For non-EU candidates: Copy of your passport page where your photo is printed. 2) Curriculum Vitae (may include hyperlinks to your ResearchID, Research Gate Google Scholar accounts). 3) Detailed list of publications if available (may include hyperlinks to DOI of publications). 4) Letter of motivation relatively to the position (Cover Letter) in which applicants describe themselves and their contributions to previous research projects (maximum 2 pages) 5) Copy of your Master degree if already available. 6) Coordinates of reference persons (maximum 3, at least your master thesis supervisor): Title, Name, organization, e-mail. If you have questions regarding the application, please contact the supervisor.