Research Grants for PhD students from the China Scholarship Council

Information Form (please read the guidelines carefully on the website www-csc.utt.fr)

Supervisor's name : FOLIO Given names : David

Status (prof., assistant prof., …) : associate professor (Dr. Habil - HDR)

Laboratory :	PRISME	Website address : https://www.univ-orleans.fr/prisme
Institution :	INSA Centre Val de Loire	Website address : https://insa-centrevaldeloire.fr

Scientific competence of the supervisor:

David Folio is involved with PRISME Laboratory, Robotic Team on modeling, control, and navigation for micro/nano-robots, mainly devoted to health and biomedical applications. Its main scientific contributions lie in the study of magnetic microrobots evolving in the human body. This original topic is an expanding research field which is a very multidisciplinary, associating robotics, biomedical, fluid mechanics, electromagnetism, and microsystems.

Two major publications in the field proposed for the PhD :

1. Ruipeng Chen, David Folio, and Antoine Ferreira, “Mathematical Approach for the Design Configuration of Magnetic System with Multiple Electromagnets,” Robot. and Auton. Syst., vol. 135, January 2021.
2. Chen, Ruipeng and David, Folio, “Electromagnetic Actuation Microrobotic Systems,” Curr. Robot. Rep, vol. 3, no. 3, September 2022. doi 10.1007/s43154-022-00081-w

Website address of the personal page :

Supervisor's email : david.folio@insa-cvl.fr

Description of the research work proposed for a PhD ***Topic # (see list) :*** I-8

Title : Modeling and simulation of magnetic microrobotic systems

Subject :

Magnetically guided microrobots attracted increasing attention in recent years, as their small scales enable the access to complex environments. Specifically, magnetic navigation is an actuation technology in which magnetic fields are used to wirelessly navigate microrobots containing magnetic materials usually in fluid medium. Motion control technology enables the development of magnetic microrobots with various controllable motion modalities, high motion accuracy, and high task efficiency. These advances promote real microrobotics applications in environments that may be complex and dynamic. To do all of this efficiently, the design of the magnetic microrobotic system needs to be further investigated.

This research work aims to deepen the use of magnetic actuation system to obtain more effective control of magnetic microrobots, considering in particular the guidance of a swarm of micro/nano-robots. The objective is then to develop a mathematical approach to efficiently model, simulate and control the magnetic field. The developed model should take into account constraints from the the magnetic microrobotic system. It is also important to determine the appropriate shape of the magnetic field, which may not necessarily be uniform as usually considered.

Keywords :

microrobotics, magnetic microrobot, magnetic microrobotic systems, electromagnetic actuation, computational modeling

Expected collaborations :

Mechanical and Automation Engineering (MAE) Department of Chinese University of Hong-Kong (CUHK), with the team of Prof. Li Zhang

Background required from the applicant :

The candidate must have an engineering background with skills in modeling and in simulation techniques.
An understanding of robotics or magnetic field theory would be appreciated.

Existence of a PDF file detailing the proposal ("yes" or "no") : yes

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