Clearing of Blood Clots in vivo under Hall Effect Sensor Guidance

Helical microrobots have the potential to swim inside Newtonian fluid (e.g., silicon oil and blood) and viscoelastic environment (e.g., tissue). Therefore, these microrobots have diverse biomedical applications, such as targeted drug delivery, cell sorting, cell characterization, and clearing of clogged arteries. In this work, we will focus on the motion control of helical robot under Hall effect sensor guidance. Since the ultimate goal of this project is to clear blood clots in vivo and that camera feedback would not be possible then, Hall effect sensor feedback would prove more beneficial.

Objective
In this work, we will focus on the closed-loop motion control of helical microrobots [1] based on Hall effect sensor feedback (Fig. 1). This should enable targeting of blood clots in vivo using two rotating dipole fields [2].

Tasks
- Fabrication of helical microrobots [3];
- Motion control of helical microrobots using the HeliMag system
- Preparation of biological samples (blood vessels and blood clots);
- Closed-loop motion control of helical robot under Hall effect sensor guidance [4];
- Clearing of blood clots in vitro and in vivo.

Materials
- HeliMag is available in MNRLab;
- Hall effect sensor is available in the MNR lab
- Helical microrobots have to be fabricated;
- Catheter segments and phosphate buffered saline.

PREREQUISITES
Students are expected to have a working knowledge of control theory, differential equations, linear systems, statics, kinematic and dynamics, dynamics at low Reynolds numbers. Familiarity with programming, especially with Matlab, LabVIEW, and C++.

OTHER NOTES
This project will involve a weekly meeting with the instructors and progress reports have to be prepared. All reports should be written in academic paper format.

1. References

