How Should Robotic Sperms Swim Back-and-Forth?

Helical microrobot can swim back-and-forth by reversing the direction of their rotation. However, robotic sperms can only swim along one direction based on planar travelling waves. It has to undergo a U-turn in order to reverse its direction of motion. In this work, we will investigate a method that will enable the robotic sperm to swim back-and-forth without making a U-turn trajectory.

Objective
We will investigate a method that enables robotic sperm to swim back-and-forth using a flagellated swim.

Tasks
• Fabrication of robotic sperms similar in morphology to the ones shown in Fig. 1. This design will only enable the robotic sperm to swim along one direction;
• Modeling of the microrobot and characterization of its magnetic and hydrodynamic properties;
• Motion control of the robotic sperm and demonstration of its ability to reverse its direction.

Materials
• 4 electromagnetic coils are available in MNRLab;
• 4 electric drivers;
• Motion control systems;
• Camera system;
• Robotic sperms can be fabricated in MNRLab;
• A feature tracking algorithm.

PREREQUISITES
Students are expected to have a working knowledge of control theory, differential equations, linear systems, statics, kinematic and dynamics. Familiarity with programming, especially with Matlab 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