Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Modeling and Navigation of Artificial Helical Swimmers in Channels[1] FATMA ZEYNEP TEMEL, ALPEREN ACEMOGLU, SERHAT YESILYURT, Sabanci University — Recent developments in micro/nanotechnology and manufacturing techniques make use of micro robots for biomedical applications realizable. Controlled in-channel navigation of swimming micro robots is necessary for medical applications performed in conduits and vessels in living bodies. Successful design and control of micro swimmers can be achieved with full understanding of hydrodynamic behavior inside channels and their interaction with channel walls and resultant flows. We performed experimental and modeling studies on untethered mm-sized magnetic helical swimmers inside glycerol-filled rectangular channels. In experiments it is observed that rotation of swimmers in the direction of helical axis leads to forward motion due to fluidic propulsion and lateral motion due to traction forces near the wall. Effects of surface roughness, swimming direction and rotation frequency on the swimmers' speed are analyzed. The flow induced by the tail motion is visualized using micro-particle image velocimetry and analyzed at different radial positions using Computational Fluid Dynamics models. Results indicate that at low frequencies traction forces are effective, however as frequency increases fluid forces become dominant and fluid flow is affecting the swimming motion of helical swimmers.

[1]We acknowledge the support from TUBITAK (Techonological & Research Council of Turkey) under the grant no: 111M376.

Serhat Yesilyurt
Sabanci University

Date submitted: 04 Aug 2013 Electronic form version 1.4