Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

Swimming of a Microrobot Actuated by a Clinical Magnetic Resonance Imaging Apparatus FREDERCK P. GOSSELIN, DAVID ZHOU, VIVIANE LALANDE, MANUEL VONTHRON, SYLVAIN MARTEL, Ecole Polytechnique Montreal — A miniature robot was designed to achieve fish-like locomotion when actuated by the imaging coils of a clinical Magnetic Resonance Imaging (MRI) system. The wireless fish robot is composed of a ferromagnetic head, a flexible tail and a float. In an aquarium placed in the MRI, the robot is set into a swimming motion by an alternating transverse linear magnetic gradient. The influence of tail length, forcing frequency and forcing magnitude on the swimming velocity and flapping amplitude are investigated. Moreover, by using a combination of simultaneous magnetic gradients, the fish can reach superior swimming speeds than can be achieved by simply "pulling" on the fish with a magnetic field. Upon further miniaturization, the propulsion principle devised here could be used to navigate a micro surgical robot or a drug delivery system. A great advantage of this system is that no energy storage, motor or control system need to be carried by the robot, allowing great miniaturization possibilities.

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Date submitted: 23 Sep 2010 Electronic form version 1.4