Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Flapping propulsion with tip pitch control[1] FRANCISCO HUERA-HUARTE, Universitat Rovira i Virgili & California Institute of Technology (Visiting Associate), MORTEZA GHARIB, California Institute of Technology — The effect of flexibility in the propulsion performance and efficiency of oscillating pitching foils has received a large amount of attention in the past years. Scientists have used simplified robotic models that mimic the kinematics of flying and swimming animals, in order to get inspiration to build more efficient engineering systems. Compliance is one of the aspects that has received more attention, as it seems to be a common feature in nature's flyers and swimmers. Active or passive control elements are also common in nature. We will show how thrust generation in a pitching fin, can be greatly affected by controlling the tip pitch motion dynamically and independently of the fin itself. This is in fact a controlled local change of curvature of the end of the fin. A robotic system has been designed in a way that not only flapping amplitudes and frequencies can be controlled, but also the amplitudes and frequencies of the tip and the phase difference between the tip and the fin. We measured thrust forces and the vortex dynamics in the near wake of the system, by using planar DPIV (Digital Particle Image Velocimetry) in a wide variety of flapping situations with tip control.

[1]Funding from Spanish Ministry of Science through grant DPI2012-37904 is gratefully acknowledged.

Francisco Huera-Huarte
Universitat Rovira i Virgili &
California Institute of Technology (Visiting Associate)

Date submitted: 25 Jul 2014 Electronic form version 1.4