Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Control of a flexible, surface-piercing hydrofoil for high-speed, small-scale applications. GABRIEL BOUSQUET, MICHAEL TRIANTAFYLLOU, JEAN-JACQUES SLOTINE, Massachusetts Inst of Tech-MIT — In recent years, hydrofoils have become ubiquitous in the design of high performance surface vehicles such as sailboats. They have proven particularly useful at small scales: while the speed of displacement-hull sailboats of length L is limited by their hull speed $\propto \sqrt{gL}$, due to wave making resistance, such limitations do not apply to hydrofoil crafts and sailboats. Such crafts of length O(1 - 10 m) are capable of reaching speeds in excess of 45 kts, often far faster than the wind. Besides, in the quest for super-maneuverability, actuated hydrofoils enable the efficient generation and control of large forces. With the intent to ultimately enable the design of small-scale, high-speed, and super-maneuverable surface vehicles, we investigate the problem of controlling the lift force generated by a flexible, surface-piercing hydrofoil traveling at high speed through a random wave field. We design a test platform composed of a rudder-like vertical foil, which is actuated in pitch, and instrumented with velocity, force, and immersion sensors. We present a feedback linearization controller, designed to operate over a wide range of velocities and sea states. Validation experiments are carried out on-the-field at speeds ranging from 3 to 10+m/s.

Gabriel Bousquet
Massachusetts Inst of Tech-MIT

Date submitted: 31 Jul 2016 Electronic form version 1.4