Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

A fish-like robot : Mechanics of swimming due to constraints PHANINDRA TALLAPRAGADA, RIJAN MALLA, Clemson University — It is well known that due to reasons of symmetry, a body with one degree of actuation cannot swim in an ideal fluid. However certain velocity constraints arising in fluid-body interactions, such as the Kutta condition classically applied at the trailing cusp of a Joukowski hydrofoil break this symmetry through vortex shedding. Thus Joukowski foils that vary shape periodically can be shown to be able to swim through vortex shedding. In general it can be shown that vortex shedding due to the Kutta condition is equivalent to nonintegrable constraints arising in the mechanics of finite-dimensional mechanical systems. This equivalence allows hydrodynamic problems involving vortex shedding, especially those pertaining to swimming and related phenomena to be framed in the context of geometric mechanics on manifolds. This formal equivalence also allows the design of bio inspired robots that swim not due to shape change but due to internal moving masses and rotors. Such robots lacking articulated joints are easy to design, build and control. We present such a fish-like robot that swims due to the rotation of internal rotors.

Phanindra Tallapragada
Clemson University

Date submitted: 23 Jul 2014 Electronic form version 1.4