Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Mechanism of maximum thrust generation by oscillating compliant caudal-fin model in a quiescent fluid[1] HYUNGMIN PARK, YONG-JAI PARK, KYU-JIN CHO, HAECHEON CHOI, Seoul National University — A certain level of flexibility of moving appendage like a fin enhances its hydrodynamic performance (e.g., thrust generation). However, little efforts have been spent to characterize the condition in which the beneficial impact of compliance is maximized. Recent report (Park *et al.* 2012, TRO) has shown that a sinusoidally oscillating caudal-fin model generates the maximum thrust when its compliance creates a phase difference (ξ) of $\pi/2$ between the oscillating and fin-bending angles, irrespective of its planform shape. To establish the underlying mechanism, we have analyzed the time-averaged and instantaneous flow fields around nine (9) oscillating caudal-fin models with varying their compliance. A series of particle image velocimetry measurements were performed in a quiescent water tank. When $\xi < \pi/2$, a strong interaction between the separated trailing-edge vortex (TEV) and the TEV forming at next stroke directs the flow in a transverse way, thereby enhancing the decay of thrust-generating jet velocity. At $\xi = \pi/2$, this interaction is weak such that the fast jet velocity is retained along the streamwise direction. On the other hand, when $\xi > \pi/2$, the trailing-edge is moving opposite to the oscillation reducing the rotational circulation of TEV.

[1]Supported by the NRF programs (NRF-2011-0028032, NRF-2013R1A1A1008373, NRF-2012M2A8A4055647), Korea.

Hyungmin Park
Seoul National University

Date submitted: 30 Jul 2013 Electronic form version 1.4