Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Sweep angle is negligible for propulsive flapping[1] ANDHINI NOVRITA ZURMAN-NASUTION, BHARATHRAM GANAPATHISUBRAMANI, GABRIEL D. WEYMOUTH, University of Southampton — The importance of the leading-edge sweep angle of propulsive surfaces used by unsteady swimming and flying animals has been an issue of debate for many years, spurring studies in biology, engineering, and robotics with mixed conclusions. In this work, we provide results from an extensive set of three-dimensional simulations of a finite foil undergoing tail-like and flipper-like kinematics for a range of sweep angles while carefully controlling all other parameters. No significant change in force and power is observed for tail-like motions (i.e. pitch-heave) as the sweep angle increases, with a corresponding efficiency drop of only $\approx 2\%$. The same findings are seen in flipper-like motion (i.e. twist-roll) although the efficiency decrease is slightly higher $\approx 6\%$ due to power increase. This leads to a conclusion that fishtails, mammal flukes and flippers can have a large range of potential sweep angles without negative impact on their performance, while at the same time, varying other hydrodynamic variables to reach the highest propulsion and efficiency.

[1]LPDP Indonesia, Iridis HPC University of Southampton,ONR Global award N62909-18-1-2091

Andhini Novrita Zurman-Nasution
University of Southampton

Date submitted: 09 Aug 2020 Electronic form version 1.4