Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Multi-fidelity Kinematic Parameter Optimization of Flapping Airfoil HONGYU ZHENG, FANGFANG XIE, YAO ZHENG, Zhejiang University, CENTER FOR ENGINEERING AND SCIENTIFIC COMPUTATION TEAM — We have constructed a multi-fidelity framework for kinetic optimization of flapping foil with inline motion. We employ multi-fidelity Gaussian process regression and Bayesian optimization to effectively synthesize the aerodynamic performance of flapping foil with the kinetic parameters under multi-resolution direct numerical simulations. The objective of this work is to demonstrate that the multi-fidelity framework can be used efficiently to discover optimal kinetic parameters of foil with desired aerodynamic performance using a limited number of expensive high-fidelity simulations combined with a larger number of inexpensive low-fidelity simulations. We efficiently identify the optimal kinetic parameters of asymmetric flapping foil with target aerodynamic forces in the design space of heaving amplitude, pitching amplitude, angle of attack (AOA) and the stroke angle. Specially, it is found that the AOA can affect the magnitude of the aerodynamic forces by violating the generation of leading-edge Vortex while its combination effect with the stoke angle can determine the attitude and trajectory of flapping airfoil.

Hongyu Zheng
Zhejiang University

Date submitted: 31 Jul 2019 Electronic form version 1.4