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Performance Estimation of a Flapping Foil Under Unsteady Upstream Flow Conditions RODRIGO VILUMBRALES GARCIA, Aerodynamics and Flight Mechanics Group, University of Southampton, UK, GABRIEL D. WEYMOUTH, Southampton Marine and Maritime Institute, University of Southampton, UK, BHARATHRAM GANAPATHISUBRAMANI, Aerodynamics and Flight Mechanics Group, University of Southampton, UK — For a system of two flapping foils in tandem formation, the follower can achieve a surplus if its location and trajectory are adapted to the wake of the leader. The most common approach to evaluating the performance of the back foil for a range of conditions is to carry out a large number of numerical simulations, which can lead to accurate solutions but, on the other hand, can be computationally expensive. Although there is a large existing literature about the topic, the physics of the operation are not completely understood, especially when the foils are subjected to highly-unstable flow conditions or unusual kinematics, such as non-sinusoidal motions. In this study, the authors aim to estimate the thrust and efficiency performance of a foil subjected to an in-line tandem arrangement using a range of theoretical and Machine Learning approximations. This could lead to a quick evaluation method that would provide deep information about the physical characteristics that are responsible for the performance augmentation, helping with the understanding of atypical cases, which would lead to a great increase in the range of applications of tandem flapping foil arrangements.

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