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COMPUTATIONAL BIOMECHANICS AND BIOMIMETICS IN FLYING AND SWIMMING

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ABSTRACT

The advantages of flying and swimming over other forms of locomotion lead to the prosperity and diversity of insects, birds, and fishes all over the globe [1]. These biological flyers and swimmers can perform with extremely robust agility and maneuverability in various complex environments using flapping wings, fins, and tails. Their flying and swimming capabilities have been increasingly refined through a long period of natural selection [2], presenting an exciting venture in biomimetics. It is expected that, through emulating nature's time-tested forms, functions, and strategies in flying and swimming animals, we can uncover their sophisticated underlying principles and mechanisms, and further explore sustainable solutions as engineering alternatives to nature's solutions to solve the practical problems in industry [3]. Biomechanics and biomimetics are a rapidly growing research area of interdisciplinary and high integration, and computational approaches are considered an essential and powerful tool to tackle the multidisciplinary problems. This mini-symposium aims to focus on computational models, numerical algorithms and methods, and computer software and frameworks in the biomechanics and biomimetics of biological flying and swimming, and their applications. The topics of interest include, but are not limited to:

(A) CFD with geometrical and kinematical complexities of a body, wings, and fins; (B) Coupled multiphysics such as wing‑air and fin‑water interactions; (C) Modelling for wings, fins, and joints, which consist of complex and multiscale structures, such as reduced order modelling and multiscale modelling; (D) Computer software and frameworks for coupled multiphysics and large-scale analyses; (E) Passivity of flexible structures, (F) Control and maneuverability in flying and swimming; (G) Simulation-based biomimetic design for flying and swimming biorobots; (H) Complementary methodologies such as scaling laws.

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