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FLOW-STRUCTURE INTERACTION IN BIO-INSPIRED LOCOMOTION/TRANSPORT PROBLEMS: METHODS AND APPLICATIONS

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ABSTRACT

Computational methods in flow-structure interaction proved to have a tangible impact on the comprehension of biological systems. These methods provided fascinating insights on biological functionalities and lead to bio-inspired solutions for engineering problems.

Early evidence suggested that the energy consumption in the locomotion/transportation sector can be significantly reduced if the fluid-dynamic performance of engineered systems approaches that of their biological analogues. In fact, significant research efforts have been focused on mimicking the drag mitigation strategies observed in biological systems. However, when considering unsteady transport phenomena at non vanishing Reynolds number, the framework of efficient motility cannot be thoroughly understood without considering both vortex dynamics and body displacement fields. Classical performance measures based on wake vortex analysis only provide indirect evaluations of the energetic consumption. In complex unsteady systems, the energetic picture of locomotion requires a simultaneous observation of structural and fluid-dynamics events. In this context, computational approaches are mature enough to faithfully capture the underlying flow-structure physics of biological transport/locomotion [1], with different levels of approximation.

The aim of this invited session is to gather the most recent developments in scientific research areas complying to the aforementioned scenario (in the Reynolds number range of about 10-1000). We warmly encourage submissions including both lumped and high-fidelity models [2]. A debate among complementary expertise is fostered, highlighting advantages, drawbacks, potentialities, and limitations of cutting-edge research for these bio-inspired applications.

REFERENCES

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