DRAG BASED FLAPPING PROPULSION WITH TIP PITCH CONTROL

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The swimming of fish is characterised by complex kinematics. These kinematics are governed not only by passive bony or cartilaginous structures, but also by active ones and tissue such as muscles. There has been a wide interest in the recent years regarding the understanding of the role of stiffness in flapping propulsion because of the implications this topic has in biomimetics and especially in all related to underwater robotics. Research has been carried out either by studying living fish or by using simplified robotics to simulate the way real fish swim. It is now evident that compliance and shape play an important role in propulsion, but passive structures are not able to exhibit some of the physics underlying the swimming of fish.

In this work we use a simplified robotic fin that allows control of the motion of the trailing edge region of the fin, to investigate the role of this active controlled surface on the propulsion performance of the system. Thrust measurements and planar velocimetry in the near wake of the fin permits identifying the best kinematics for thrust production while operating in a wide variety of amplitude, frequency and phase difference situations.