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The role of tip deflection on the thrust produced by rigid flapping fins FRANCISCO HUERA-HUARTE[1], Department of Mechanical Engineering, Universitat Rovira i Virgili, MORTEZA GHARIB, Division of Engineering and Applied Science, California Institute of Technology — It is well known that flexibility plays an important role in the propulsion performance and efficiency of oscillating fin based propulsion systems. Compliance is one of the aspects that has received more attention, as it seems to be a common feature in nature's flyers and swimmers. Active control strategies are also common in nature. We will show how by deflecting only the last 10% of length of a rigid fin, at the tip, the thrust can be changed dramatically. This can be thought as an alternative to passive flexibility for controlling very efficiently the momentum transfer in the wake and therefore the thrust generation when flapping. A series of experiments have been carried with a robotic fin that allowed the control of its flapping kinematics as well as the control of the motions of its tip independently. We will be showing situations in which the tip was kept at a certain fixed position during a power stroke, and others in which it moved either in-phase or out-of-phase with the fin. The observed thrust and wake dynamics will be discussed for all these situations. The authors would like to acknowledge the financial support provided by the Gordon and Betty Moore Foundation and by the Spanish Ministerio de Economia y competitividad (MINECO) through grant DPI2012-37904.

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