

Abstract Submitted  
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**Energy extraction from a semi-passive flapping-foil turbine with active heave and passive pitch**<sup>1</sup> MATTHIEU BOUDREAU, GUY DUMAS, KEVIN GUNTHER, Univ of Laval, CFD LABORATORY LMFN TEAM — Due to the inherent complexity of the mechanisms needed to prescribe the heaving and the pitching motions of optimal flapping-foil turbines, several research groups are now investigating the potential of using unconstrained passive motions. The amplitude, the phase and the frequency of such free motions are thus the result of the interaction of the blade with the flow and its elastic supports, namely springs and dampers. In parallel with our current study on fully-passive flapping-foil turbines (Boudreau et al., APS 2016), we investigate in this work the possibility of using a semi-passive turbine. Unlike previous semi-passive turbines studied in the literature, we propose a turbine with a passive pitching motion and an active heaving motion constrained to be a sine wave with desired amplitude and frequency. As most of the energy extracted by flapping-foil turbines comes from the heaving motion, it is natural to connect an electric generator to this degree of freedom, thereby allowing one to constrain this motion. It is found that large-amplitude pitching motions leading to a considerable energy extraction can arise under different circumstances and mechanisms, either forced by the heaving motion or driven by an instability of the pitching motion itself.

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