Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

**Unsteady loads mitigation using flexible wings**[1] GABRIELE PISETTA, IGNAZIO MARIA VIOLA, School of Engineering, University of Edinburgh — In nature, fluid flows are inherently unsteady, and any wing-like device immersed in them experiences loads fluctuations. In some cases, these fluctuations may result in fatigue failures, and thus they strongly affect the reliability of the whole device. An effective control strategy would consist in a passive device capable of applying fast, local control action. This can be achieved using a flexible structure. In this presentation, we consider the loads on a tidal turbine operating in a shear flow, and we introduce a novel blade design to reduce the load fluctuations. We show that a blade with a flexible trailing edge can mitigate the fluctuations of the blade root bending moment, without affecting the mean torque, and thus the power generated by the turbine. Using a numerical method based on the seminal work of Theodorsen, we model the foils flexibility as a torsional spring, and we perform a parametric study to identify the optimal spring parameters. The dynamic analysis of the system shows that the fluctuations of the root bending moment can be reduced by 93%. Our results prove the potential of a flexible structure to alleviate the loads fluctuations arising on a wing in an unsteady flow, and they underpin the development of more sophisticated models of flexible wings.

[1]This work is supported by EPSRC, grant number EP/L016680/1.

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Date submitted: 30 Jul 2019 Electronic form version 1.4