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Dynamic Response of an Energy Harvesting Device Under Realistic Flow Conditions JOSEPH O'CONNOR, ALISTAIR REVELL, University of Manchester — The need for reliable, cost-efficient, green energy alternatives has led to increased research in the area of energy harvesting. One approach to energy harvesting is to take advantage of self-sustaining flow-induced vibrations. Through the use of a piezoelectric flag, the mechanical strain from the flapping motion can be converted into electrical energy. While such devices show a lot of promise, the fluid-structure-electrical interactions are highly nonlinear and their response to off-design variations in flow conditions, such as those likely to be encountered upon deployment, is relatively unexplored. The purpose of the present work is to examine how a representative energy harvesting device performs in realistic atmospheric flow conditions involving wind gusts with spatial and temporal variations. A recently developed lattice-Boltzmann-immersed boundary-finite element model is used to perform fully-coupled 3D simulations of the fluid-structure system. For a range of unsteady flow conditions the resulting flow features and structural motion are examined and key behaviour modes are mapped out. The findings of this work will be particularly relevant for self-powered remote sensing networks, which often require deployment in unpredictable and varied environments.

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