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Fluttering, twisting and orbital motions of wall-mounted flexible plates YAQING JIN, The University of Texas at Dallas, SHYUAN CHENG, LEONARDO P. CHAMORRO, University of Illinois at Urbana-Champaign — The dynamics of wall-mounted flexible plates under inclined flows was studied for a variety of Cauchy numbers using theoretical arguments and laboratory experiments. . Particle tracking velocimetry and a high-resolution force sensor were used to characterize the plate dynamics and aerodynamic force. Results show three distinctive modes of tip oscillations, which are modulated by the structure dynamics and flow instability. The first mode is characterized by small-amplitude motions occurring under a critical Cauchy number. Past this condition, the motions are dominated by unsteady twisting patterns. The onset of this mode is characterized by a sharp increase of the force fluctuation intensity. At sufficiently high Cauchy number and flow inclination, the plate may undergo a third mode dominated by large-scale tip orbits about the mean bending. We propose a formulation to estimate the critical Cauchy number as a function of inclination angle, which agrees well with experiments.

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