Abstract Submitted
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On the rotation and pitching of flat plates. YAQING JIN, SHENG JI, LEONARDO P. CHAMORRO, University of Illinois at Urbana-Champaign — Wind tunnel experiments were performed to characterize the flow-induced rotation and pitching of various flat plates as a function of the thickness ratio, the location of the axis of rotation and turbulence levels. High-resolution telemetry, laser tachometer, and hotwire were used to get time series of the plates motions and the signature of the wake flow at a specific location. Results show that a minor axis offset can induce high-order modes in the plate rotation under low turbulence due to torque unbalance. The spectral decomposition of the flow velocity in the plate wake reveals the existence of a dominating high-frequency mode that corresponds to a static-like vortex shedding occurring at the maximum plate pitch, where the characteristic length scale is the projected width at maximum pitch. The plate thickness ratio shows inverse relation with the angular velocity. A simple model is derived to explain the linear relation between pitching frequency and wind speed. The spectra of the plate rotation show nonlinear relation with the incoming turbulence, and the dominating role of the generated vortices in the plate motions.

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