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On the multiscale oscillations of a hinged plate under stratified turbulence SHYUAN CHENG, Department of Mechanical Science and Engineering, University of Illinois, Urbana, IL, 61801, YAQING JIN, Department of Mechanical Engineering,The University of Texas, Richardson, TX, 75080, LEONARDO P CHAMORRO, Department of Mechanical Science and Engineering, University of Illinois, Urbana, IL, 61801 — Wind-tunnel experiments were conducted to quantify the unsteady motions of a rigid plate under stratified turbulence containing spatially-varied, energetic vortices. The structure was able to oscillate around a vertical axis located at a quarter chord length from the leading edge. Vertically-oriented, von-Karman vortices that varied in frequency and strength along the vertical span of the plate were imposed using a variety of tapered cylinders. Telemetry and hotwire anemometry were used to characterize the motions of the plate, and wake at selected locations. Results show that the plate oscillation is dominated by two distinct modes. One of them, f_p, corresponds to the mean flow-induced oscillation frequency; whereas the other, f_v, is related to the vortex shedding cells from the non-uniform cylinders. These frequencies exhibited distinct trends with the distance from the cylinders, and the distribution of the coherent motions, which were determined by the tapered ratio of the cylinders. A simple model is proposed to estimate f_v.

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