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Lift production of a hovering pyramid in an oscillatory airflow ANNIE WEATHERS, Dept. of Physics, New York University, BRENDAN FOLIE, Dept. of Math, Harvey Mudd College, BIN LIU, STEPHEN CHILDRESS, Courant Institute, New York University, JUN ZHANG, Dept. of Physics and Courant Institute, New York University — We investigate the dynamics of rigid, hollow "pyramids" placed within a background airflow, oscillating with zero mean. The asymmetry of the body introduces a net upward force. We find that when the amplitude of the airflow is above a threshold, the net lift exceeds the weight and the object hovers. Our results show that the objects hover at far smaller air amplitudes than would be required by a quasi-steady theory. We find that paired vortices are generated during each period of the oscillatory flow, which provide the lift. We also observe that lighter objects do not necessarily hover more easily, because they tend to be entrained by the flow, reducing the relative motion and the resultant lift. In fact a finite flow amplitude is observed to be required for hovering in the limit of zero body mass.

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