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Coexistence of two types of flight, hovering, and the stability in the insect's free flight MAKOTO IIMA, Hokkaido University — We study the insects free flight using a simple model. This model includes a wing flapping horizontally and the center point of the flapping (oscillation). In this model, all the mass is concentrated at the center point. The point, which is equivalent to the center of mass (CM), is allowed to move in a one-dimensional vertical direction according to the hydrodynamic force generated through flapping. Numerical simulation revealed that the model exhibits two types of flapping flight: a steady flight in which the CM velocity oscillates and a wandering flight in which the CM velocity varies irregularly. These two types of flights can coexist in a parameter region. Moreover, at a certain critical parameter value, the steady flight loses its stability and experiences a drastic transition to the wandering flight. At this critical value, the steady flight can be regarded as hovering. The possible flights are analyzed in terms of bifurcation, and the bifurcation structure is qualitatively explained based on a simple analysis using the tethered model.

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