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System identification and sensorimotor determinants of flight maneuvers in an insect SIMON SPONBERG, Georgia Tech, ROBERT HALL, EATAI ROTH, Univ. of Washington — Locomotor maneuvers are inherently closed-loop processes. They are generally characterized by the integration of multiple sensory inputs and adaptation or learning over time. To probe sensorimotor processing we take a system identification approach treating the underlying physiological systems as dynamic processes and altering the feedback topology in experiment and analysis. As a model system, we use agile hawk moths (*Manduca sexta*), which feed from real and robotic flowers while hovering in mid air. Moths rely on vision and mechanosensation to track floral targets and can do so at exceptionally low luminance levels despite hovering being a mechanically unstable behavior that requires neural feedback to stabilize. By altering the sensory environment and placing mechanical and visual signals in conflict we show a surprisingly simple linear summation of visual and mechanosensation produces a generative prediction of behavior to novel stimuli. Tracking performance is also limited more by the mechanics of flight than the magnitude of the sensory cue. A feedback systems approach to locomotor control results in new insights into how behavior emerges from the interaction of nonlinear physiological systems.

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