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Sparse Sensing of Aerodynamic Loads on Insect Wings KRITHIKA MANOHAR, Applied Mathematics, Univ of Washington, STEVEN BRUNTON, Mechanical Engineering, Univ of Washington, J. NATHAN KUTZ, Applied Mathematics, Univ of Washington — We investigate how insects use sparse sensors on their wings to detect aerodynamic loading and wing deformation using a coupled fluid-structure model given periodically flapping input motion. Recent observations suggest that insects collect sensor information about their wing deformation to inform control actions for maneuvering and rejecting gust disturbances. Given a small number of point measurements of the chordwise aerodynamic loads from the sparse sensors, we reconstruct the entire chordwise loading using *sparse sensing* - a signal processing technique that reconstructs a signal from a small number of measurements using l_1 norm minimization of sparse modal coefficients in some basis. We compare reconstructions from sensors randomly sampled from probability distributions biased toward different regions along the wing chord. In this manner, we determine the preferred regions along the chord for sensor placement and for estimating chordwise loads to inform control decisions in flight.

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