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Prediction of aerodynamic loads in turbulent flow conditions ANDREAS NATSIS, Portland State University, RAL BAYON CAL TEAM, ALEXANDER J. HUNT TEAM — Birds and bats have a remarkable ability to isolate body motion in turbulent air. Hairs and feathers, spread out across their wings and body, sense the movement of the air (turbulence) before it has a significant effect on the motion of the animal. Analogously, distributed pressure sensors over a wing are used and the acquired data is analyzed with Neural Networks. An airfoil (NACA 0018, 60 cm span, 10 cm chord) with one degree of freedom (roll) was subjected to airflow with high intensity turbulence and an average speed of 10 m/s. The wing was tapped with multiple MEM pressure sensors with 1KHz sampling rate and its roll was recorded. Long short-term memory (LSTM) neural networks processed the information gathered by the pressure sensors and predicted roll by 20 ms. This is in stark contrast to most stability controllers utilized in flying vehicles to date. Current controllers make use of inertial measurement units (IMUs) located in the main body and require motion to occur before attempting to counter it. These results indicate that a bioinspired controller using pressure sensors is possible and may overcome inherent limitations of traditional IMU based controllers.

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