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Attitude stabilization of flapping micro-air vehicles via an observer-based sliding mode control method

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Abstract

This paper introduces an observer-based sliding mode control strategy for stabilizing the attitude of flapping micro-air vehicles in the presence of unknown uncertainties and external disturbances. First, a finite-time observer is designed to estimate the lumped disturbances. Next, a controller is developed to provide attitude stabilization with high robustness where the lumped disturbances could be completely rejected after a finite amount of time. The stability of the closed-loop system is rigorously proven. By employing MATLAB/Simulink software, a numerical simulation example including a comparison between the proposed method and a conventional sliding mode controller is provided to illustrate the effectiveness of the proposed method and to confirm the theoretical results.

Keywords: Flapping micro-air vehicles, Attitude stabilization, Finite-time observer, Sliding mode control

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