ICCES, 2023, vol.25, no.1
DOI: 10.32604/icces.2023.09859

PROCEEDINGS

Virtual Manipulation of Tail Postures of a Barn Owl Demonstrates Longitudinal Static Unstability when Gliding

Changyao Chen[1], Jialei Song[1,*], Ling Yin[1], Yizhe Li[2], Zheng Yuan[2] and Yuhan Li[3]

[1]Dongguan University of Technology, Dongguan, Guangdong, 523000, China
[2]Shenzhen University, Shenzhen, Guangdong, 518060, China
[3]South China University of Technology, Guangzhou, Guangdong, 511442, China
[*]Corresponding Author: Jialei Song. Email: songjl@dgut.edu.cn

ABSTRACT

Bird can switch between high maneuverability and high stability due to its ability to substantially morph wings and tail. Tail as an auxiliary lift surface, plays an important role on lift and drag production and also significantly affects the longitudinal stability. In this study, we reconstruct a high-fidelity barn owl model using the point cloud of its surface obtained from high-speed photogrammetry, and simulate the fluid dynamics using a commercial software. By virtually manipulating the tail to a series of postures, we analyze the aerodynamics and static stability for each tail posture, investigating the strategy to adjust the stability during gliding flight. For simplification, only the tail pitch and spread are studied, with the tail spread angle ranging from to and the pitch angle ranging from to, which enveloping regular adjustment of the tail. Our preliminary study shows that the tail could not achieve the static stability with the original wing postures, indicating that tail alone could not be sufficient for stability control. The result of further study will benefit the design of agile morphing micro air vehicles.

KEYWORDS

Bird flight; longitudinal static stability; angle of attack; pitching moment

Funding Statement: This study is sponsored by Basic and Applied Basic Research Fund of Guangdong Province (2020A1515110584).

Conflicts of Interest: The authors declare that they have no conflicts of interest to report regarding the present study.