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平尾积冰对飞机纵向气动参数的影响

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Effects of Tailplane Icing on Aircraft Longitudinal Aerodynamic Parameters

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摘要

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摘要

建立飞机纵向动力学模型,基于最大似然参数估计原理,设计用于辨识飞机纵向气动参数的辨识系统,并对辨识系统的正确性和精确度进行了验证。以DHC-6飞机飞行试验数据为依据,对未积冰飞机和两种平尾积冰冰型的飞机进行纵向气动参数辨识,通过对比3种情况下飞机纵向气动参数的辨识结果,定量分析了平尾积冰对飞机纵向气动参数的影响。结果表明:平尾积冰将导致飞机纵向气动特性恶化,俯仰阻尼可减小15%,升降舵效率可降低20%,对飞行稳定性、操纵性以及飞行安全构成一定的威胁。

关键词: 飞机 平尾积冰 最大似然估计 气动参数 参数辨识

Abstract:

A longitudinal flight dynamics model for an aircraft is built, and a system for identifying the aircraft longitudinal aerodynamic parameters is constructed using the maximum likelihood parameter estimate method. The validity and accuracy of the identification system is verified. According to the flight test data of aircraft DHC-6, the aerodynamic parameters of a clean aircraft and two different cases of iced aircraft with particular ice shapes on the tailplane are identified. Based on the comparison of the three identification results of the aircraft longitudinal aerodynamic parameters, an analysis is made on the effects of tailplane icing on the aircraft longitudinal aerodynamic parameters. The results of the analysis could show that tailplane icing has several adverse effects on aircraft longitudinal flight characteristics. The pitching dampness of the aircraft would decrease up to 15% and the elevator effectiveness would decrease up to 20%, which indicates that tailplane icing has adverse effects on the aircraft stability, controllability and could pose a threat to flight safety.

Keywords: aircraft tailplane icing maximum likelihood estimate aerodynamic parameters parameter identification

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