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### 大型客机先进翼尖装置综合特性研究

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### A Comprehensive Study on Wingtip Devices in Large Civil Aircraft

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摘要

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**摘要** 翼尖装置由于其良好的气动特性在航空界得到了广泛应用,然而它也使飞机的颤振及结构重量特性发生了变化。为了探求翼尖装置的综合特性,利用数值模拟方法对大型客机上最先进的3种翼尖装置(融合式、鲨鱼鳍式和阶梯式)进行了气动、颤振及重量3个方面的综合研究。3种翼尖装置减阻效果明显,但同时结构重量亦增加。翼尖装置均降低了机翼颤振速度。研究表明:加装翼尖装置后机翼颤振形态取决于翼尖装置的形式。相对于机翼颤振速度,翼尖装置形式对机翼颤振速度的影响是小量(1%~7%),且翼尖装置减阻和机翼压心外移的综合重量增益,为机翼结构设计提供了一定的设计空间。

**关键词:** 翼尖装置 气动 颤振 重量 大型客机

**Abstract:** Wingtip devices are commonly used on aircraft because of their good aerodynamic characteristics. However, the flutter characteristics of the aircraft are changed by the devices, and so is the structural weight. In order to explore the overall performance of the wingtip devices in a large civil aircraft, three kinds of wingtip devices (blended, sharklet, ladder) are studied in terms of aerodynamics, fluttering and weight by numerical simulation. There are obvious benefits from drag reduction by adding any of the three wingtip devices, but the structural weight increases as a result. The flutter velocity of the wing is reduced by adding a wingtip device. The results show that the flutter shape depends on the form of the wingtip device. The effect on the flutter velocity of the wing due to the form of the wingtip device is about 1%-7%, which is relatively small. And the overall weight benefits from drag reduction and the displacement of the pressure center can provide certain weight capacity for the structural design.

**Keywords:** wingtip device aerodynamics flutter weight large civil aircraft

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