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250座级翼身融合无尾布局客机操稳特性设计研究

张曙光, 陆艳辉, 巩磊, 刘晓静

北京航空航天大学 交通科学与工程学院, 北京 100191

Research on Design of Stability and Control of a 250-seat Tailless Blended-wing-body Civil Transport Aircraft

ZHANG Shuguang, LU Yanhui, GONG Lei, LIU Xiaojing

School of Transportation Science and Engineering, Beihang University, Beijing 100191, China

摘要 翼身融合(BWB)飞翼布局是未来新一代客机的热点方案之一,然而由于没有常规尾翼,面临着稳定性和操纵性方面的困难。为此,在一架250座级BWB客机布局设计研究基础上,根据平衡、增稳和机动等要求,设计了操纵面配置方案;根据适航要求和电传飞机飞行品质要求设定增稳目标,并将其直接纳入特征结构配置要求中,通过前向通道修正响应类型,保证获得与飞行阶段相适应的响应特征和满意的飞行品质参数;为了提高安全性,在增稳控制设计基础上,在指令回路增设了姿态保护和限制模块。研究结果表明, 该设计方案能够提供较合适的稳定性和操纵性,控制增稳后具有满意的飞行品质,保护模块可达到预期效果。

关键词: 翼身融合 操纵面 响应类型 飞行品质 姿态保护

Abstract: While facing challenges in terms of stability and control due to the lack of conventional tails, the blended-wing-body (BWB) flying wing aircraft configuration is one of the hot baselines for next generation transport airplanes. On the basis of a 250-seat BWB experimental configuration, the control surfaces are configured according to trim, stability augmentation and maneuverability considerations with margins for disturbances. Requirements from airworthiness regulations and flying qualities are set as design goals and incorporated into the eigenstructure assignment method to find stability augmentation solutions. Special consideration is placed on the forward path to provide the desired response type. A roll attitude protection system is designed to improve the flight safety. The results show that the stability and control are sufficient, that the flying qualities are satisfactory after stability augmentation, and that the roll attitude protection system works as expected.

Keywords: blended-wing-body control surface response type flying qualities roll attitude protection

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Corresponding Authors: Tel.: 010-82315237 E-mail: gnahz@buaa.edu.cn Email: gnahz@buaa.edu.cn

About author: 张曙光(1969-) 女,博士,教授,博士生导师。主要研究方向:飞行力学与飞行控制、复杂系统安全性。 Tel: 010-82315237 E-mail: gnahz@buaa.edu.cn

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