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平流层飞艇环境适应性评价模型

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Environmental Adaptability Evaluation Model for Stratospheric Airships

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摘要

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摘要

阐述了平流层特别是20 km高度左右平流层的环境特点,分析了各种环境因素对长期在此空域中驻留飞行的平流层飞艇性能的影响,在此基础上,建立了平流层飞艇环境适应性评价指标体系。并针对其各评价指标的物理意义不同且数量级相差较大的特点提出了基于物理规划和层次分析法相结合的综合评价模型。算例和分析结论表明:抗风速度余量和产生消耗能量比在平流层飞艇对其飞行环境的适应能力评价中占有重要比重,应成为飞艇总体方案设计和论证时的重点关注指标。

关键词: 平流层飞艇 环境适应性 物理规划 层次分析法 评价模型 概念设计

Abstract:

In this paper, the environmental characteristics of the stratosphere, especially the 20 km height stratosphere, is described, and the influence of diversified environmental factor to performance of stratospheric airships which should have the ability that reside there for a long time is analyzed. On this basis, a stratospheric airship environmental adaptability evaluation index system is developed. In view of the large differences existing in the magnitude and physical meaning of the attribute indices about stratospheric airships' conceptual design performance evaluation, a comprehensive evaluation model which combines physical programming and analytic hierarchy process is proposed. Finally, a real example is provided. The example and analysis of the results show that resisting wind speed allowance and energy generation exhaust ratio play a crucial role in the environmental adaptability capacity evaluation of stratospheric airships. They should receive more attention during airship conceptual design and argumentation.

Keywords: stratospheric airship environmental adaptability physical programming analytic hierarchy process evaluation model concept design

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