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流体力学与飞行力学

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多段翼型缝翼流动非定常性的试验研究

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Experimental Investigation of Effect of Slat on Unsteadiness of Multi-element Airfoil

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摘要

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摘要 为了探索缝翼噪声的流体动力学机理,在西北工业大学NF-3低速风洞中用动态压力传感器研究多段翼型在不同条件下绕前缘缝翼流动的非定常性。分析了雷诺数、来流迎角、缝翼和襟翼参数(偏角、缝道宽度和搭接量)对缝翼流动的非定常性影响规律。研究表明:缝翼流动非定常性与流动雷诺数、缝翼参数、襟翼参数和来流迎角密切相关,初步揭示了缝道涡的变化趋势和对翼型表面流动的影响以及缝翼噪声产生的原因。该试验研究结果对研究多段翼型噪声产生及抑制方法具有一定的指导意义。

关键词: 多段翼型 缝翼 动态压力 非定常流动 噪声

Abstract: For the exploration on principle of slat noise investigation on the unsteady flow of a leading edge slat of a multi-element airfoil under different conditions with unsteady pressure transducers placed around the slat cove region is performed in the two-dimensional testing section of a NF-3 wind tunnel at Northwestern Polytechnical University. It analyzes the relationship between the flow unsteadiness and the Reynolds number, angle of attack, parameters of slat and flap (deflecting angle, gap, overlap). Through comparison, the study demonstrates that the Reynolds number, slat position, flap position and angle of attack can all influence the flow unsteadiness of the slat cove. It also reveals the change and trend of the vortex in the slat cove region and the front of the main wing region, its influence on the flow over the airfoil, as well as the cause of the slat noise. The study is of considerable significance to the investigation of noise source and noise reduction of multi-element airfoils.

Keywords: multi-element airfoil slat dynamic pressure unsteady flow noise

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