



航空学报 » 1993, Vol. 14 » Issue (6) :225-229 DOI:

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柔性自适应壁风洞的翼型实验技术

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AIRFOIL TEST TECHNIQUE ON FLEXIBLE ADAPTIVE WIND TUNNEL

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摘要

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摘要 给出一种新的二维跨音速柔性自适应壁风洞实验迭代方案,计算方法和实验验证结果。根据实验时实验段上下壁和模型上下表面实测压强分布对风洞内、外流场进行非线性数值模拟;计算流线化壁面的形状,进行自适应实验。用该迭代方案,在堵塞比 $\epsilon=8\%$,实验段高与翼型弦长比值 $H/c=1.5$ 情况下,对NACA-0012翼型进行了高亚音速验证性实验。实验结果与国外大风洞无干扰实验结果吻合很好。实验时迭代次数仅需1~2次。实验结果展示了自适应壁风洞实验技术用于翼型跨音速实验的前景。

关键词: 柔性自适应壁风洞 跨音速翼型实验 洞壁干扰 实验迭代方案

Abstract: In this paper, a new iterative testing strategy is described for two dimensional model testing in transonic flexible adaptive walled wind tunnel and wall adjustment computing method. The results are presented. At first, the interior and exterior flowfields of the wind tunnel are computed by using the transonic small perturbation equation based upon the boundary conditions of pressure distribution measured both along the top and bottom flexible walls and on the airfoil upper and lower surfaces. Next, the free-air flow around the equivalent body is computed to obtain the streamlining wall shape. According to the new iterative testing strategy, experiments had been done in Northwestern Polytechnical University high speed flexible adaptive walled test section with an NACA-0012 airfoil with 8% of blockage. It can be seen that our experimental results agree well with the free data by large wind tunnel abroad. And the experimental interative times are only 1 -2. It is further displayed that the testing technique of flexible adaptive walled wind tunnel could apply to future transonic airfoil testing.

Keywords: flexible adaptive walled wind tunnel transonic airfoil testing wall interference experimental iterative strategy

Received 1991-11-29; published 1993-06-25

引用本文:

徐敏;贺家驹;左培初;李华星. 柔性自适应壁风洞的翼型实验技术[J]. 航空学报, 1993, 14(6): 225-229.

Xu Min;He Jia-ju;Zuo Pei-chu;Li Hua-xing. AIRFOIL TEST TECHNIQUE ON FLEXIBLE ADAPTIVE WIND TUNNEL[J]. Acta Aeronautica et Astronautica Sinica, 1993, 14(6): 225-229.

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