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## 低雷诺数NACA0012平面叶栅流场直接数值模拟

## Direct numerical simulation of NACA0012 cascade flow at low Reynolds number

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中文关键词: [直接数值模拟](#) [低雷诺数](#) [平面叶栅](#) [涡脱落](#) [WENO\(weighted essentially non-oscillatory\)差分格式](#)英文关键词: [direct numerical simulation](#) [low Reynolds number](#) [cascade flow](#) [vortex-shedding](#) [WENO\(weighted essentially non-oscillatory\) scheme](#)

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作者	单位
<a href="#">朱海涛</a>	<a href="#">北京航空航天大学 能源与动力工程学院, 北京 100191</a>
<a href="#">单鹏</a>	<a href="#">北京航空航天大学 能源与动力工程学院, 北京 100191</a>

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中文摘要:

采用具有7阶精度的weighted essentially non-oscillatory(WENO)差分格式,直接求解可压缩二维非定常N-S方程组,研究了NACA0012翼型平面叶栅低雷诺数流动的特征.直接模拟及与文献对比的结果表明:叶栅尾缘涡脱落的形成过程与圆柱绕流涡脱落的形成过程非常相似.平面叶栅尾迹区的2阶统计量与孤立翼型尾迹区的2阶统计量具有相同的分布特征,但前者的强度显著大于后者.周期性的涡脱落不仅在上下翼面形成非定常分离,也使得尾迹区某点的总压发生准周期性的变化.随着栅距的减小,翼型上的平均分离位置向前缘移动;尾迹区某点的总压变化频率及其幅值均显著地增加;而且栅距越小,速度脉动2阶统计量反而越大.

英文摘要:

Low Reynolds number flow field developed around a cascade of NACA0012 was numerically simulated by directly solving the unsteady two-dimensional Navier-Stokes equations through weighted essentially non-oscillatory(WENO) schemes with 7th order accuracy. As compared with references, direct numerical simulation results indicate that vortex-shedding process at the cascade trailing edge is similar to that of flow over a cylinder and the statistical traits of the wake region are similar between cascade flow and single airfoil flow at low Reynolds number, but the former is stronger. The vortex-shedding has a significant impact on the overall flowfield, which forms unsteady separation on the airfoil and makes the total pressure in the wake region vary instantaneously. With the decrease of the pitch, the average separation position moves towards the leading edge; the frequency and amplitude of total pressure in the wake region increase markedly, and the statistics of pulse velocity becomes bigger.

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