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运动平板附近圆柱绕流的数值模拟

郑海成, 施卫平, 李秀文

吉林大学 数学学院, 长春 130012

摘要：

用格子Boltzmann方法模拟运动平板附近的圆柱绕流问题, 给出一种精确确定临界间隙率的综合判定方法, 并分析了流场特性的内在本质以及各种物理现象之间的联系. 将圆柱置于运动平板上方, 平板运动速度与入口处均匀来流的速度保持一致, 模拟的雷诺数为 1 000. 定义间隙率为 G/D, 其中G为圆柱边界到运动平板的最小距离, D 为圆柱的直径. 结果表明: 当间隙率取值范围不同时, 流场特性有较大差异; 与孤立圆柱相比, 本文中的升力和阻力有明显增加, 并且旋涡脱落也受到平板抑制.

关键词： 格子Boltzmann方法； 圆柱； 运动平板； 阻力； 旋涡脱落

Numerical Simulation of Flow Past a Circular Cylinder near a Moving Plane

ZHENG Hai cheng, SHI Wei ping, LI Xiu wen

College of Mathematics, Jilin University, Changchun 130012, China

Abstract:

The flow past a circular cylinder near a moving plane was simulated. The circular cylinder was placed over a moving plane which moved at the same velocity of uniform flow at the inlet. The Reynolds number was 1 000 in present simulation. The gap ratio was defined as G/D, where G represents the nearest distance of circular cylinder to the moving plane and D is the diameter of the circular cylinder. Numerical simulations show that the flow patterns are very different at various gap ratios. Compared with those of flow past an isolated circular cylinder, the present lift and drag coefficients increase obviously, and the vortex shedding is suppressed by the plane.

Keywords: lattice Boltzmann method circular cylinder moving plane drag force vortex shedding

通讯作者: 施卫平

作者简介:
作者Email: shiwp@jlu.edu.cn

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