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求解非定常N-S方程的一种自适应时间步长的罚函数有限元方法

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AN ALGORITHM OF PENALTY FUNCTION FINITE ELEMENT AND SELFADAPTIVE TIME INTEGRATION FOR UNSTEADY NAVIER-STOKES EQUATION

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摘要

本文提出了一种求解速度-压力变量形式的非定常不可压N-S方程的数值方法。其中采用罚函数的Galerkin有限元进行空间离散,改进了梯形法的时间积分格式并结合自适应时间步长技术使计算效率最优。文中对圆柱突然启动到Re=100和200时的流场进行了数值模拟,所得到的Karman涡街的诱发过程是满意的。

关键词： 非定常流 N-S方程 有限元素法

Abstract:

This paper presents a numerical method for solving the unsteady, incompressible Navier-Stokes equations in terms of primitive variables. The method is composed of a penalty Galerkin finite element procedure for spatial discretization, in conjunction with an improved trapezoidal rule for time integration. A self-adaptive time step technique is imposed into the time marching to make the calculation most costefficient.The entire process beginning from vortex shedding through the formation of Karmann vortex street for impulsively started circular cylinder at Re =100 and 200 are simulated, and the results are compared with those obtained by other methods.

Keywords: uneteady flow N-S equation finite element