



航空学报 » 1998, Vol. 19 » Issue (6) :67-70 DOI:

论文

[最新目录](#) | [下期目录](#) | [过刊浏览](#) | [高级检索](#)

[<<](#) [<](#) [前一页](#) | [后一页](#) [>](#) [>>](#)

有限元法求解QPNS方程模拟高速旋成体气动力和热

张国富, 花锡青

南京航空航天大学601 教研室, 南京, 210016

SOLUTION OF QPNS EQUATIONS TO SIMULATE AERODYNAMIC FORCES AND HEATING FOR ROTATION BODIES AT HIGH SPEED USING FINITE ELEMENT METHOD

Zhang Guofu, Hua Xiqing

Faculty 601, Nanjing University of Aeronautics and Astronautics, Nanjing, 210016

摘要

参考文献

相关文章

Download: [PDF \(259KB\)](#) [HTML](#) 0KB Export: [BibTeX](#) or [EndNote \(RIS\)](#) [Supporting Info](#)

摘要 从FNS方程中略去流向粘性导数项导出熵变量形式QPNS方程(拟抛物化N-S方程)其离散解能自动满足熵增不等式。利用GLS(伽辽金/最小二乘法)有限元法构造出QPNS方程的弱解式,所形成的整体方程组用GMRES(广义最小余数法)求解。采用空间推进求解QPNS方程,能明显降低计算机内存和运算时间。算例给出典型旋成体的物面压强、剪应力、热流量分布以及流场中密度、温度分布。

关键词: GLS有限元法 QPNS方程 旋成体

Abstract: The QPNS equations in the entropy variable are derived from the FNS equations by neglecting streamwise viscous derivatives. The discrete solution always satisfies the entropy production inequality. The QPNS equations are solved with a spacemarching method. The step back strategy is used to provide the data of the initial plane. The Galerkin/least squares finite element method is employed to formulate the weak solution of QPNS equations. The nonsymmetric linear equation systems are solved by GMRES algorithm. The nodal block diagonal preconditioning technique is used to accelerate the convergence rate efficiently. The present method markedly reduces the amount of computer storage and run time. It shows a good stability as well. Numerical examples are the supersonic flows past the parabolic body and tangent ogive body. The results include the pressure, viscous stress, heat flux on the body surface, and the density, temperature in the flow field of windward and leeward.

Keywords: GLS finite element method QPNS equations rotation body

Received 1996-12-17; published 1998-12-25

引用本文:

张国富;花锡青. 有限元法求解QPNS方程模拟高速旋成体气动力和热[J]. 航空学报, 1998, 19(6): 67-70.

Zhang Guofu; Hua Xiqing. SOLUTION OF QPNS EQUATIONS TO SIMULATE AERODYNAMIC FORCES AND HEATING FOR ROTATION BODIES AT HIGH SPEED USING FINITE ELEMENT METHOD[J]. Acta Aeronautica et Astronautica Sinica, 1998, 19(6): 67-70.

Service

- ▶ 把本文推荐给朋友
- ▶ 加入我的书架
- ▶ 加入引用管理器
- ▶ Email Alert
- ▶ RSS

作者相关文章

- ▶ 张国富
- ▶ 花锡青