



航空学报 2012, Vol. 33 Issue (1) :34-43 DOI: CNKI:11-1929/V.20110615.1322.005

流体力学与飞行力学

最新目录 | 下期目录 | 过刊浏览 | 高级检索

<< Previous Articles | Next Articles >>

缝隙-腔体密封结构在高速气流冲击下的整体流动、传热特性分析

沈淳¹, 夏新林¹, 曹占伟², 于明星²

- 1. 哈尔滨工业大学 能源科学与工程学院, 黑龙江 哈尔滨 150001;
- 2. 北京临近空间飞行器系统工程研究所, 北京 100076

Analysis of Flow and Heat Characteristics of Seal Structure with Gap and Cavity Under the Impact of High Speed Airflow

SHEN Chun¹, XIA Xinlin¹, CAO Zhanwei², YU Mingxing²

- 1. School of Energy Science and Engineering, Harbin Institute of Technology, Harbin 150001, China;
- 2. Beijing Institute of Nearspace Vehicles System Engineering, Beijing 100076, China

摘要

参考文献

相关文章

Download: PDF (1727KB) HTML 1KB Export: BibTeX or EndNote (RIS) Supporting Info

摘要 根据高马赫数流场特征参数变化快、固态场特征参数变化慢的特性,编制开发了针对高速气流的“半解耦”显式流固耦合近似计算程序,并通过数值方法分析了该方法的计算误差,分析结果显示其能够较准确地模拟高速流场与固态场长时间非稳态耦合问题.在此基础上,运用“半解耦”流固耦合方法数值模拟了高速气流横掠缝隙-腔体典型密封结构的非稳态过程,并与相关实验测试数据进行了对比,验证了程序可靠性.随后,进一步分析了气流侵入密封结构的主要特性,总结了密封结构内、外流场中气流温度、压力和速度的分布特征以及其随时间的变化规律,研究了密封结构中加热板气动热流随时间的变化规律,探讨了密封结构中固体温度场分布特征及其随时间积累的变化规律等.最终,计算结果说明了密封体的结构布局对其内部热状况的决定性影响.

关键词: 流固耦合 高速气流 数值模拟 密封结构 非稳态过程

Abstract: In view of the fact that the characteristic parameters of a high Mach flow field vary much faster than those of the solid field, a program of approximate numerical simulation of the semi-decomposed fluid and solid coupling is developed and compiled. The calculating error of the method is analyzed by numerical simulation, and the results show that this method can accurately simulate the fluid and solid coupling in a high speed airflow field during a long unsteady process. The process of a high speed airflow impacting the seal structure is simulated by this method and the program is proved to be feasible after a comparison of the calculated results with the related experimental test. And then the features of the airflow invading the seal structure are analyzed. The contours of the flow field temperature, pressure and velocity inside and outside the seal structure and the their variation during the course of an unsteady process are summarized. The variation of the aerodynamic heat flux of the heating board with time is analyzed. The rules of the temperature variation of the seal structure with time are investigated. Finally, the results show that the structural layout of the seal plays a decisive role in the seal structure's thermal conditions.

Keywords: fluid and solid coupling high speed airflow numerical simulation seal structure unsteady process

Received 2011-04-18;

Fund:

国家自然科学基金(90816022)

Corresponding Authors: 夏新林 Email: xiaxl@hit.edu.cn

About author: 沈淳 男,博士研究生.主要研究方向: 相间耦合传热、传质. Tel: 0451-86412148 E-mail: shenchun390@sina.com

夏新林 男,博士,教授,博士生导师.主要研究方向: 热辐射、辐射-对流-相变耦合换热、红外特性与传输. Tel: 0451-86412148 E-mail:

xiaxl@hit.edu.cn

引用本文:

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

