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旋转通道内流阻特性实验的实现与验证

Realization and verification of the flow characteristic experiment in rotating two-pass square duct with smooth walls

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中文关键词: 旋转测压 内冷通道 高压 高旋转数 高雷诺数 实验技术

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作者 单位

陈豪 北京航空航天大学 能源与动力工程学院航空发动机气动热力国家级重点实验室,北京 100191;中国航空工业集团公司 中国航空动力机械研究所,湖南 株洲 412002;先进航空发动机协同创新中心,北京 100191

邓宏武 北京航空航天大学 能源与动力工程学院航空发动机气动热力国家级重点实验室,北京 100191;先进航空发动机协同创新中心,北京 100191

程俊华 北京航空航天大学 能源与动力工程学院航空发动机气动热力国家级重点实验室,北京 100191;先进航空发动机协同创新中心,北京 100191

李洋 北京航空航天大学 能源与动力工程学院航空发动机气动热力国家级重点实验室,北京 100191;先进航空发动机协同创新中心,北京 100191

田淑青 中国航空工业集团公司 商用航空发动机有限责任公司 设计研发中心,上海 201108

中文摘要:

针对涡轮叶片的蛇形内冷通道内流阻特性的研究,在北京航空航天大学航空发动机气动热力国家级重点实验室的旋转涡轮叶片内冷通道换热实验台上构建了旋转工况的测压系统.该测压系统具有高精度、多路选通、高压高旋转数等特点.在通道进口雷诺数从20000~70000,旋转数从0~1.025的范围内,实验研究了旋转状态下,冷态与热态流场下方形截面光滑U形通道流阻系数.实验结果与国外同类实验对比验证了构建的实验系统的可靠性和优越性.实验结果表明:低雷诺数下静止工况的流阻随雷诺数增大而增大,并在雷诺数增大到一定值后转而减小.冷态下流阻随旋转数增大而增大,低旋转数下旋转对热态流阻影响并不显著,高旋转数下热态流阻随旋转数增大而显著增大.

英文摘要:

In order to investigate the pressure and flow characteristics of the rotating channels, a new measurement system was invested and implemented in National Key Laboratory of Science and Technology on Aero-Engine Aero-Thermodynamics of Beijing University of Aeronautics and Astronautics. The new measurement system with high measurement accuracy and plural air channels could reach high Rotation numbers by increasing the back pressure of test section. The Reynolds and Rotation numbers ranged from 20000 to 70000 and 0 to 1.025 respectively. The investigation used different temperature ratio conditions to investigate the pressure and flow characteristics of the rotating two-pass square duct with smooth walls. The results proved the reliability and superiority of the measurement system by comparing with similar experiments in foreign countries. The result showed that the static flow resistance increased with the increasing Reynold number, and decreased when the Reynold number was high enough. In cold conditions, the flow resistance increased with the increasing Rotation number. In thermal state, the flow resistance showed no obvious change in low Rotation number, and increased significantly with the increasing Rotation number in high Rotation number.

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