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张村元, 钟易成, 徐伟祖, 潘尚能. 涡轮导叶前缘多排孔冷气掺混数值模拟[J]. 航空动力学报, 2013, 28(8):1744~1751

涡轮导叶前缘多排孔冷气掺混数值模拟

Numerical simulation of coolant air injection at leading edge of turbine stator with rows of holes

投稿时间: 2012-08-15

DOI:

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英文关键词: [screwy coolant turbine stator](#) [injection angle](#) [source point](#) [aerodynamic performance](#) [cooling characteristics](#) [coolant injection](#)

基金项目:

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中文摘要:

针对某三维扭转冷却涡轮导叶在前缘开设3排冷却孔,冷却孔流向夹角均为 90° ,径向射流角分别为 30° , 60° 和 90° ,分别采用点源项与真实孔射流两种方法对前缘冷却孔气动性能和冷却特性进行了对比研究,分析了点源项与真实孔冷气掺混机制以及不同径向射流角对叶栅通道流场和冷却特性的影响.结果表明:真实冷却孔射流对前缘附近约10%轴向弦长范围内的流动影响较大,冷却效果涵盖了整个导叶;点源项方法所得压力与非冷却涡轮很接近;冷气径向喷射角减小,真实孔模型导叶表面温度下降了8%~16%,而点源项模型导叶表面温度降低了21%~23%.在工程实际中不能将点源项法计算结果用作定量评估依据.

英文摘要:

The leading edge of a three-dimensional screwy coolant turbine stator was numerically simulated when the injection angles of the row of holes were 30° , 60° and 90° respectively, and the lateral direction angles were all 90° . Source point and hole jet methods were adopted separately to study comparatively the aerodynamic performance and cooling characteristics on the leading edge; the mechanism of coolant injection and the influence of different injection angles on the field of cascade flow and cooling characteristics were analyzed. The results show that film holes influence obviously the flow field near the leading edge of about 10% axial chord length range, and the cooling effect covers the entire leaf. The pressure of source point method is very close to non-cooled turbine. With the decrease of cooling air radial injection angle, the surface temperature of real holes model drops by 8% to 16%, but that of source point model by 21% to 23%. The results of source point method can not be taken as a quantitative basis for assessment in engineering.

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