

动力机械与工程

旋转叶片气膜冷却效果的数值研究

郭婷婷 张玲 邹晓辉 李少华

东北电力大学能源与机械工程学院 华北电力大学能源与动力工程学院 东北电力大学能源与机械工程学院 东北电力大学能源与机械工程学院

摘要: 采用数值模拟方法研究了静止和旋转涡轮叶片表面不同工况下的气膜冷却效果, 计算给出了吹风比 M=1.0、1.5等工况下静止和旋转叶片压力面、吸力面的气膜冷却效率, 以及不同射流孔下游的气膜冷却效率, 并分析了旋转和吹风比对气膜冷却效果的影响。结果表明: 静止叶栅, M=1时叶片气膜冷却效果较好, 旋转叶栅, M=1.5时叶片气膜冷却效果较好; 叶栅在高速旋转时, 冷却气流对射流孔附近区域影响不大, 叶片尾缘附近气膜冷却效率呈现先增大后减小的趋势; 叶片高速旋转时, 产生的离心力使冷却气流流向叶顶区域, 靠近叶顶区域的气膜冷却效率值较高。

关键词: 旋转叶片 气膜冷却 紊动射流 数值模拟

Numerical Study on the Film Cooling Effect of Rotating Blades

GUO Ting-ting ZHANG Ling ZOU Xiao-hui LI Shao-hua

Abstract: Film cooling effectiveness of rotating turbine blades was investigated by numerical simulation. Calculations of turbine stationary and moving blades were carried out under the conditions of different blowing rate M=1.0, 1.5, the results of film cooling efficiency on pressure and suction surfaces were given and analyzed. Calculation results show that stationary cascade, the film cooling efficiency is better when blowing rate M=1, while rotation turbine, the film cooling efficiency is better at M=1.5; Cascades with high rotation speed, the cooling effect near the jet-hole area is weak, and the film cooling efficiency increases at first and then decreases near the trailing edge; When the blades rotate with high speed, because of the centrifugal force, the cooling air flow towards blade tip, and the values of the film cooling efficiency are higher around the blade tip region.

Keywords: rotating blade film cooling turbulent jet numerical simulation

收稿日期 2008-04-01 修回日期 1900-01-01 网络版发布日期

DOI:

基金项目:

通讯作者: 郭婷婷

作者简介:

作者Email: tingting_guo2002@sina.com; tingting_guo2002@sina.com.cn

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