▼ 在 《机械工程学报》

中检索

首页→_《中国机械工程学报》最新OA论文→Numerical Analysis of Nozzle Clearance's Effect on Turbine Performance

Numerical Analysis of Nozzle Clearance's Effect on Turbine Performance

HU Liangjun^{1*}, YANG Ce¹, SUN Harold², ZHANG Jizhong³, and LAI MingChia⁴

1 School of Mechanical Engineering, Beijing Institute of Technology, Beijing 100081, China 2 Ford Motor Company, Michigan, 48124 USA

3 National Key Laboratory of Diesel Engine Turbocharging Technology, Datong, Shanxi 037036, China 4 Wayne State University, Michigan, 48122 USA

Received September 22, 2010; revised March 17, 2011; accepted March 21 2011; published electronically March 23, 2011

Abstract: Variable nozzle turbine (VNT) has become a popular variable geometry turbine (VGT) technology for the diesel engine application. Nozzle clearance, which can't be avoided on the hub and shroud side of the VNT turbine due to the pivoting stators, can lead to turbine performance deterioration. However, its mechanism is still not clear. In this paper, numerical investigation, which is validated by experiment, is carried out to study the mechanism of the nozzle clearance's effect on the turbine performance. Firstly, performance of the mixed flow turbine with fixed nozzle clearanceis tested on flow bench. Performance of the tested turbine with the same nozzle clearance is numerically simulated. The numerical result agrees well with the test data, which proves correct of the numerical method. Then the turbine performance with different nozzle clearances is numerically analyzed. The research showed that with nozzle clearance, flow loss in the nozzle increases at first and it reaches the maximum value when the clearance ratio is 5%. Flow at the exit of the nozzle becomes less uniform with nozzle clearance. The negative incidence angle of the rotor also increases with nozzle clearance and leads to more incidence angle loss in the rotor. The low energy fluid formed in the nozzle due to the nozzle clearance migrates from hub to shroud side in the rotor, which is another main reason for the rotor's performance degradation. The present research exposed the mechanism of the dramatically decrease of the turbine performance with nozzle clearance: (a) The loss associated with the nozzle leakage increases with the nozzle clearance; (b) The flow loss grows up quickly in the rotor due to the incidence angle loss and migration of the low energy fluid from hub to shroud side.

Key words: nozzle clearance, variable nozzle turbine (VNT), mixed flow turbine

☆English ☆旧版网站

^{*}Corresponding author Email: lhu0808@gmail.com

关于我们-联系我们-网站地图-广告服务-人才招聘-加盟合作-法律声明

地址: 中国北京百万庄大街22号 **邮编:** 100037 **电话:** 8610-88379907 **传真: E-mail:** cjme@mail.machineinfo.gov.cn **http:** // www.cjmenet.com.cn 传真: 8610-68994557

©2006 版权所有《机械工程学报》编辑部

