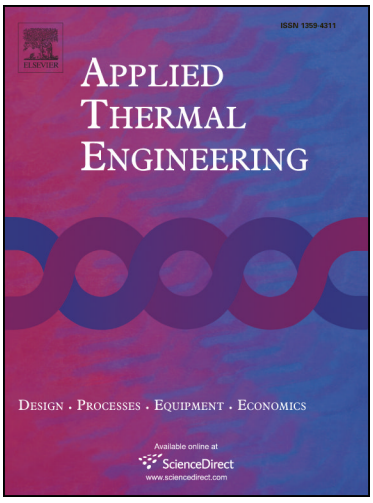

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PII: S1359-4311(17)33532-9
DOI: https://doi.org/10.1016/j.applthermaleng.2017.11.010
Reference: ATE 11380

To appear in: *Applied Thermal Engineering*

Received Date: 23 May 2017
Revised Date: 18 October 2017
Accepted Date: 2 November 2017

Please cite this article as: D. Jun, W. Songtao, X. Hao, C. Le, W. Zhongqi, S. Jiaqi, The Effect of Aspiration configuration on Aerodynamic Performance in Compound Lean Compressor Cascades of Gas Turbines, *Applied Thermal Engineering* (2017), doi: https://doi.org/10.1016/j.applthermaleng.2017.11.010

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ABSTRACT

Advantages and disadvantages of typical aspiration configurations applied in compound lean compressor cascades are discussed in this paper. The blade leaning mechanism is elaborated first, and then a thorough study on the synergistic effect of aspiration and blade leaning on the flow field structure and the aerodynamic performance, especially the boundary layer development in blade passages, which is conducted by CFD. The calculations show that the spanwise pressure gradient in positive lean cascades is adopted to reduce the corner loss. Meanwhile, with increasing incidence, the reversal flow is accumulated near the midspan due to the redistribution of the boundary layer, which contributes to the broadening of the operation range. With the introduction of suction surface aspiration, the loss of the cascade is effectively reduced which results from the suppression of the boundary layer development on the blade suction surface. However, due to the limited controlling capacity towards the corner separation, the boundary layer thickness in the corners is almost unaffected, which leads to the restricted improvement of the operation range. Endwall aspiration is more powerful in removing the corner separation to significantly delay the occurrence of hub-stall. Nonetheless, the increased aspirated flow loss counteracts the loss reduction near the endwalls.

KEYWORDS

Numerical simulation; Compound lean cascade; Aspirated cascade; Compressor cascade

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