References

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Comparison of 2-D and rotation measurements of cascades with flat plate profiles

by

H. Heinemann

Two flat plate cascades of different geometry are investigated in the 2-D-cascade wind tunnel and the facility for rotating (annular) cascades to compare the results. Moreover, measurements are taken for another tip-section cascade, the geometry and profile of which are described in Ref. [1]. This cascade is developed and also examined at the VKI, Rhode St. Genese, Belgium. The exit flow conditions are changed from subsonic up to supersonic velocities. The inlet angle is also varied. The pitch-chord ratio and the stagger angle of the first flat plate cascade are $g/c = 1.2$ and $\gamma = 15^{o}$ and for the other one $g/c = 1.0$ and $\gamma = 25^{o}$. The wake flow measurements are compared in the case of the flat plate cascades for both DFVLR-AVA facilities. In the case of the third tip-section cascade the surface pressure measurements and the wake flow measurements are compared with the results of the VKI.

The main results are as follows:

All results are in good agreement for all cascades, except for supersonic Machnumbers in the outlet plane. In this case the results for the 2-D-wind tunnel and the facility for rotating cascades do not agree. The increase of losses happens in the case of the facility for rotating cascades at a lower Machnumber than in the case for the 2-D-wind tunnel. An explanation for this fact can be given looking for the different test conditions: in the case of the 2-D-wind tunnel only the losses produced by a limited number of blades are taken into account and in the case of the facility for rotating cascades the measurements are taken for an infinite cascade. Another reason may be the centrifugal forces in the facility for rotating cascades, because the rpm of the test wheels is up to 13 000/min. It seems to be necessary to investigate this influence by using different guide vanes, which cause a different rpm for the same inlet angle. The problem of the blockage of the probe, which could happen investigating straight cascades, seems to be of less influence in the case of the rotating test wheel, because in the absolut system mainly subsonic velocities appear. Another problem, which could appear testing straight cascades, consists in getting uniform flow upstream of the cascade. This is easier to be achieved in the case of testing a rotating test wheel, because the flow is uniform to all blades.

The comparison of the results of both 2-D-wind tunnels is also quite good, mainly for the surface pressure measurements. Some differences may be explained by the different Reynoldsnumbers.

A detailed description of the experimental results is given in Ref. [2,3,4].

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Measurements of secondary flows in a transonic axial-flow compressor

by

G. Bois, F. Leboeuf, A. Comte and K.D. Papailiou

1. INTRODUCTION

Measurements were performed using two different probes (put at an angle of 90°) at one station upstream and two stations downstream of the rotating wheel of a transonic compressor. These measurements were performed in order to increase our knowledge about the behaviour of the viscous shear layers near the end walls of the compressor.

Special probes were conceived which permitted us to approach the stationary or rotating hub ("hub" probe) and the stationary tip ("tip" probe) and care was taken to ensure that for a certain radial distance, measurements were taken by both probes (overlapping region).

In the present paper the probes will be examined first and then their behaviour in a uniform stream (probe calibration). In the following the behaviour of the probes will be examined in the transsonic compressor environment as well as the quality of the measurements. Lastly some remarks will be made as far as the interpretation of the measurements is concerned.

2. THE PROBES AND THEIR CALIBRATION

Combined probes for total pressure, static pressure, one direction, and total temperature were conceived in order to diminish the measuring time in a costly installation.

Two probes were used (see photo (1)): a cylindrical-wedge-type probe ("tip" probe, figure (1)) which permitted us to approach the tip end