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Investigation concerning Flow Behavior in a Conical Vaneless Diffuser

Seiichi MATSUMOTO*

A vaned radial or conical diffuser gives flow separation on the vane, when the flow angle deviates from the design inlet flow angle. The efficiency of a vaneless diffuser is not so high as that of a vaned diffuser for a specific design angle, but the vaneless diffuser gives a good performance throughout wide range of inlet angles. It was found by experiments that the pressure ratio in an impeller of a mixed-flow compressor was higher than that of a radial compressor, and also that the efficiency of the mixed-flow diffuser was not so high as that of the radial diffuser. In the absence of wakes from the impeller or other unsteady flow phenomena, the development of a boundary layer or separation on the side walls of the diffuser is conceivable as the main cause of losses in diffuser efficiency.

Thus, the author conducted an experiment about the behavior of flow and effect of friction in a conical vaneless diffuser, and then compared the results with that of the radial vaneless diffuser.

Thus, the following conclusions were obtained. The total pressure decreases asymptotically to a constant value with increasing r/r_0 . Because of deviation of main steam to hub side, the flow perpendicular to the wall is larger on shroud than on hub. Friction factors, Reynolds numbers and the gradient of static pressure decrease with r/r_0 . Comparing conical diffuser with radial diffuser at $\beta=15^\circ$ and $G_0=0.085$ kg/s, it is found that the total and static pressure and friction factor and of radial diffuser is larger than that of conical diffuser.

*松本誠一