EFFECT OF LEADING EDGE STACKING ON THE AERODYNAMIC PERFORMANCE OF A MULTISTAGE AXIAL FLOW COMPRESSOR

Nitin B. Balsaraf
Scientist
Gas Turbine Research Establishment (GTRE)
Defence Research and Development Organisation
Min of Defence, CV Raman Nagar
Bangalore-560 093, India
Email : nitinbalsaraf@gtre.drdo.in

S. Kishore Kumar
DRDO Fellow
Gas Turbine Research Establishment (GTRE)
Defence Research and Development Organisation
Min of Defence, CV Raman Nagar
Bangalore-560 093, India
Email : s.kishore.kumar2@gmail.com

Abstract

The aerodynamic performance of axial flow compressor is a function of blade geometry, flow path geometry and radial stacking method of two dimensional blade profiles at different blade heights along the span. The radial blade stacking in flow path is generally carried out using centroid of the individual blade profiles. Radial stacking of blades on leading edge reduces the secondary flow in radial direction due to axial shift of blade profiles from hub to tip as compared to stacking on centroid. Leading edge stacking reduces tip clearance vortex intensity and secondary losses which improves the aerodynamic performance. In this paper, two dimensional blade profiles are stacked at their leading edge in a transonic three stage axial flow compressor. The stacked blade along with flow path is modelled and computational fluid dynamics analysis is carried out for one passage of the blades to study the effect on aerodynamic performance. To improve the performance further axial sweep and lean is incorporated based on analysis of the flow field. The constant speed characteristics at design condition are generated using these results. The characteristics show that the efficiency and surge margin improve significantly.

Keywords: Aerodynamic Performance, Radial Stacking, Blade Profile, Pressure Ratio, Efficiency, Surge Margin