Abstract Submitted
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Effect of Axial Casing Grooves on the Structure of Turbulence in the Tip Region of an Axial Compressor rotor passage[1] SUBHRA SHANKHA KOLEY, Johns Hopkins University, HUANG CHEN, Georgia Tech University, AYUSH SARASWAT, JOSEPH KATZ, Johns Hopkins University — Stereo PIV measurements performed in a refractive index matched facility examine the effect of axial casing grooves (ACGs) on the structure of turbulence in the tip region of an axial compressor rotor. The ACGs delay the onset of stall at low flowrates by entraining the Tip Leakage Vortex (TLV), and by causing periodic changes to incident angle as their outflow impinges on the rotor blade. However, ACGs typically cause undesirable loss of efficiency at design flowrates. Interactions of the tip flow with ACGs modifies the magnitude and spatial distribution of the highly anisotropic and inhomogeneous components of the turbulent kinetic energy (TKE). Owing to TLV entrainment, at low flowrate the ACGs reduce the turbulence in the passage compared to that of the smooth endwall, but the anisotropy varies with the groove geometry. Still, the TKE is high in the TLV, the shear layer separating the backward leakage flow with the main passage, flow and near the corner of the grooves. At high flowrates, interactions of the TLV with secondary flows generated by typical grooves increase the tip region turbulence. This adverse effect and associated efficiency loss can be mitigated using grooves that minimize the injection of secondary flows into the passage at high flowrates.

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