ENTROPY GENERATION IN A HIGHLY-LOADED, AXIAL TURBINE

Abstract

by

Ethan Perez

Entropy generation in a highly-loaded, axial turbine stage was investigated at on and off-design conditions. Deviation angle, total pressure, total temperature, and specific entropy change were measured experimentally and used as validation for a RANS simulation. A RANS entropy transport model was proposed in order to decompose entropy transport into reversible and irreversible components. Experimental measurements determined that the simulation over-predicted entropy in regions where the fluid was under-turned. Investigation of the numerical simulation identified localized regions within the blade passage that were associated with significant entropy generation. Furthermore, the interaction of reversible entropy transport and entropy generation was identified in these regions. Entropy generation was most significant in the suction-surface boundary layer and the passage vortex. Reversible entropy transport transferred the entropy generated in these regions to adjacent areas. Entropy generation at on and off-design conditions was investigated. It was discovered that the viscous component of entropy generation was the most significant component at all operating points investigated.