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Entropy Generation in Three-dimensional, Swirling Flows SCOTT MORRIS, ETHAN PEREZ, JOSHUA CAMERON, ALEKSANDAR JEMCOV, University of Notre Dame — Entropy generation in a transonic, highly loaded, axial turbine stage has been investigated via application of the entropy transport equation. The use of a RANS simulation required additional consideration of entropy transport associated with the time-averaging of products of fluctuating quantities. Analysis of the RANS entropy transport equation allowed the investigators to calculate the volumetric distribution of $\overline{D\bar{s}}/\overline{Dt}$; that is, the time rate of change of mean entropy of a material particle. The quantity $\overline{D\bar{s}}/\overline{Dt}$ revealed localized regions of entropy increases and decreases of material particles. It was discovered that regions of large $+\overline{D\bar{s}}/\overline{Dt}$ occur primarily on the blade suction surface. Additionally, it was found that the passage vortex core, typically associated with high entropy fluid, corresponded with regions of $\overline{D\bar{s}}/\overline{Dt} \approx 0$. This result suggests that entropy is generated on the blade suction surface and then collected and convected by the blade passage vortex.

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