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LARGE EDDY SIMULATION OF FLOW THROUGH THE T106D LOW PRESSURE TURBINE CASCADE

Saji M, Joseph Mathew
Laboratory for Turbulence Computations
Department of Aerospace Engineering
Indian Institute of Science
Bangalore-560 012, India
Email : ersaji639@gmail.com, joseph@iisc.ac.in

Abstract

Large eddy simulations were performed of the flow through the T106D low pressure turbine cascade at exit Reynolds number Re_{2th} = 60,000 using an explicit filtering method. Sixth-order compact differences for spatial derivatives and a 2nd-order Runge-Kutta method for time stepping were used. A 10th-order low pass filter was applied to transported fields. Simulations with uniform inflow and flow with inlet Freestream Turbulence (FST) of 1%. Results were compared with experiments. The isentropic Mach number over the blade shows good agreement with experiment, except over a small portion of the suction surface near the mid-chord. A shallow separation was captured in both cases. Natural transition occurs for uniform inflow and bypass transition with inlet FST, but surface pressure distribution changes little. Flow structures were visualized as iso-surfaces of the second invariant Q of the velocity gradient tensor. Wake pressure loss coefficient had been measured at the plane 40% chord from the blade trailing edge. In the LES, wake pressure loss for flow with FST of 1% is slightly higher than that with uniform inflow in the vicinity of the wake. Overall, the results obtained from the LES are in good agreement with the experiment.

Keywords: Low-Pressure Turbine, EFLES