Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Compressible DNS of transitional and turbulent flow in a low pressure turbine cascade[1] RAJESH RANJAN, SURESH DESHPANDE, RODDAM NARASIMHA, JNCASR — Direct numerical simulation (DNS) of flow in a low pressure turbine cascade at high incidence is performed using a new in-house code ANUROOP. This code solves compressible Navier-Stokes equations in conservative form using finite volume technique and uses kinetic-energy consistent scheme for the flux calculations. ANUROOP is capable of handling flow past complex geometries using hybrid grid approach (separate grid topologies for the boundary layer and rest of the blade passage). This approach offers much more control in mesh spacing and distribution compared to elliptic grid technique, which is used in many previous studies. Also, in contrast to previous studies, focus of the current work is mainly on the boundary layer flow. The flow remains laminar on the pressure side of the blade, but separates in the aft region of the suction side leading to transition. Separation bubbles formed at this region are transient in nature and we notice multiple bubbles merging and breaking in time. In the mean flow however, only one bubble is seen. Velocity profiles very near to the leading edge of the suction side suggest strong curvature effect. Higher-order boundary layer theory that includes effect of curvature is found to be necessary to characterize the flow in this region. Also, the grid convergence study reveals interesting aspects of numerics vital for accurate simulation of this kind of complex flows.

[1]We would like to thank the Gas Turbine Enabling Technology (GATET) Program for funding this project. We also thank C-DAC, Pune and CSIR-4PI, Bangalore for providing computational resources.

Rajesh Ranjan
JNCASR

Date submitted: 03 Aug 2015 Electronic form version 1.4