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Aero-Thermal Prediction in High Pressure Turbine Cascade using Large Eddy Simulation RATHAKRISHNAN BHASKARAN, SANJIVA LELE, Stanford University — The aero-thermal performance of an uncooled, smooth high pressure (HP) turbine cascade in the presence of free-stream turbulence is studied using a high-order overset mesh Large Eddy Simulation (LES) procedure. A HP vane cascade designed at the von Karman Institute (VKI) for fluid dynamics, Belgium, is used as the model geometry. Simulations matching experimental conditions, except for the Reynolds number which is about half of the experimental value, have been carried out. Significant enhancement in the blade heat-transfer is seen in the presence of inflow turbulence. Eddies from the free-stream turbulence get stretched around the blade, creating long streaky structures in the blade boundary layer. These structures quickly break down on the suction side, while they persist on the pressure side. The blade heat transfer signature from the simulations does not show transition of the boundary layer at the Reynolds number of the simulation. This is consistent with the trend seen in the experiments where transition is delayed by lowering the Reynolds number. New simulations matching the experimental Reynolds number are currently under way.

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