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Large Eddy Simulations of a Stationary Smooth-Wall Isothermal Serpentine Passage FREDERIC FELTEN, LASKOWSKI GREGORY, GE Global Research — Gas turbine blade cooling strategies consist of serpentine passages with streamline curvature, rib-roughened walls and are subjected to strong rotational and thermal effects. The ability to predict the heat transfer is a major problem and is dependant on the ability to predict the turbulent flowfield. LES have been conducted for an internal cooling passage model in order to determine the ability of LES to capture strong curvature effects. Simulations of fully developed turbulent flow in an isothermal, smooth-wall, stationary serpentine passage have been performed and compared to the DNS data of Laskowski(2004). The geometry is $12\pi\delta$x2δx$3\pi\delta$, in the streamwise, wall-normal and spanwise directions, respectively, where δ is $1/2$ the passage height. The inner radius of the bends is δ. The Reynolds number based on the bulk velocity and δ is Re_b=2800. A kinetic-energy conserving, finite-volume scheme, using a collocated-mesh arrangement for simulation of turbulence in complex geometries, as described by Felten & Lund(2006), is applied to treat the streamwise and wall-normal directions, while Fourier collocation is used in the spanwise direction. A 3^{rd} order Runge-Kutta explicit marching scheme is used to advance the solution in time while the pressure Poisson equation is solved using a multigrid technique. The LES results are presented and close agreement with DNS is reported. Simulations focusing on the rotating case of Laskowski(2004) are ongoing.

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