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Modeling Compressible Turbulent Flow past a Blunt Nosed Body with Spinning Base.[1] IGBAL MEHMEDAGIC, DONALD CARLUCCI, U. S. Army, ARDEC, Picatinny Arsenal, NJ, SIVA THANGAM, Stevens Institute of Technology, NJ — Flow over blunt-nosed cylinders that are spinning about their axis and subject to wall heating is analyzed with applications to projectile design. In this study, computations are performed using an anisotropic Reynolds-stress model to study compressible flow past spinning projectiles subject wall heat flux. The model utilizes a phenomenological treatment of the energy spectrum and diffusivities of momentum and heat to include the effects of rotation, wall heat transfer and compressibility. The time-averaged equations of motion and energy are solved using the modeled form of transport equations for the turbulence kinetic energy and the scalar form of turbulence dissipation with an efficient finite-volume algorithm. The experimental results of Carlucci & Thangam (2001) are used to benchmark isothermal flow over spinning cylinders. The model is applied for several test cases to validate its predictive capabilities for capturing the effects of swirl, wall heat transfer and compressibility. Compressible flow past single rigid cylinder as well as that of flow past cylinders with a free-spinning are analyzed and compared with experimental data available in the literature. Applications involving the design of projectiles are summarized.

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