Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Computational and Experimental Investigations of Flow past Spinning Cylinders[1] IGBAL MEHMEDAGIC, LIAM BUCKLEY, PASQUALE CARLUCCI, DONALD CARLUCCI, U. S. Army ARDEC, Picatinny Arsenal, NJ, ELIAS ALJALIS, SIVA THANGAM, Stevens Institute of Technology, Hoboken, NJ, STEVENS-ARDEC COLLABORATION — An anisotropic two-equation Reynolds-stress model is developed by considering the modifications to the energy spectrum and through invariance based scaling. In this approach the effect of rotation is used to modify the energy spectrum, while the influence of swirl is modeled based on scaling laws. The resulting generalized model is validated for benchmark turbulent flows with swirl and curvature. 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. Computations for flow past an axially rotating cylinder with a free-spinning base are performed along with experiments for a range of spin rates and free stream flow conditions. A subsonic wind tunnel with a forward-sting mounted spinning cylinder is used for experiments. The experimental results of Carlucci & Thangam (2001) are used to benchmark flow over spinning cylinders. The data is extended to munitions spinning in the wake of other munitions and applications involving the design of projectiles are discussed.

[1]This work was funded in part by U. S. Army ARDEC.

Siva Thangam
Stevens Institute of Technology, Hoboken, NJ

Date submitted: 02 Aug 2012 Electronic form version 1.4