Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Large-eddy simulations of coherent vortices embedded in an impinging jet WEN WU[1], UGO PIOMELLI[2], Department of Mechanical and Materials Engineering, Queen's University, Kingston (Ontario), Canada — Large-eddy simulations of impinging jets with embedded ring vortices are carried out to study the interaction between the axisymmetric wall jet generated away from the impingement region and the vortex rings. After the primary vortex interacts with the wall, a secondary vortex (with opposite-sign vorticity) is formed from the lifted wall vorticity, which is stretched and wrapped around the primary one. The instability of the secondary vortex dramatically increases the three-dimensionality of the vortex pair. Turbulence statistics reveal a very strong interaction between the two, and intense turbulence generation. The liftup of wall turbulence also results in the generation of rib-like vortices that roll around the primary vortex ring. A three-dimensional, sinusoidal instability of the main vortex is also observed, as well as the generation of near-wall streamwise vortices, which may be related to the striations observed when vortex rings impinge on a sand bed. The stretching and dissipation eventually cause the destruction of the coherent structures of the vortices.

[1]Ph.D candidate, Queen's University.
[2]Professor, Canada Research Chair in Computational Turbulence, HPCVL-Sun Microsystems Chair in Computational Science and Engineering, AIAA Associate Fellow.

Wen Wu
Department of Mechanical and Materials Engineering,
Queen's University, Kingston (Ontario), Canada

Date submitted: 25 Jul 2012 Electronic form version 1.4