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Effects of ground plane topology on vortex-ground interactions in a forced impinging jet[1] JAYSON GEISER, KYLE CORFMAN, KEN KIGER, University of Maryland — The phenomenon of a three-dimensionally unstable vortex-ground interaction is studied, motivated by the problem of sediment suspension by vortex-wall interactions from landing rotorcraft. In the current work, the downwash of a rotorcraft is simplified using a prototype flow consisting of an acoustically forced impinging jet. The goal of the current investigation is to quantify the effects of disturbances to the ground-plane boundary layer on the three-dimensional development of the vortex ring as it interacts with the ground plane. A small radial fence is employed to perturb the natural evolution of the secondary vortex, which typically exhibits azimuthal instabilities as it is wrapped around the primary vortex. The fence is observed to localize and intensify the azimuthal development, dramatically altering the mean flow in this region and generating corresponding azimuthal variations in the turbulent near-wall stresses. Multi-plane ensemble-averaged stereo PIV is employed to obtain volumetric, phase averaged data sets that are subjected to a triple decomposition to fully quantify turbulence effects. The effects of the radial fence are examined at both a high and low Reynolds number flows (Re = Γ/ν = 50,000 and 10,000, respectively), and the data is analyzed in the context of structures leading to significant sediment mobilization.

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Jayson Geiser
University of Maryland

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