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Impingement of Ring Vortices on a Wall - a Comparison of Experiments and Computations JASON DEGRAW, JOHN CIMBALA, Penn State University — The descending disk experiments of Kubota et al. (2008) generate ring vortices that impinge upon the floor and travel outward from the disk. These vortices do not exhibit some of the complex behavior that is found in the simulations of Khalifa and Elhadidi (2007) and DeGraw and Cimbala (2006). Among the leading candidates for the differences between the simulations and the experiments is the possible presence of turbulence in the experiment that is not present in the simulations. To study this possibility, we numerically simulate the related but simpler case of an axisymmetric ring vortex impinging upon a plane wall as both a laminar and a turbulent flow. In the laminar case, the primary vortex induces separation vortices that are periodically ejected from the surface and tend to stop growth of the primary vortex. In the turbulent case, we find that while a separation vortex may develop, it tends to be smaller and no ejection takes place. We simulate a variety of cases in which we turn turbulence on or off (in the form of the $k - \epsilon$ turbulence model), and find that the ejection-type behavior is present only in the laminar solutions, while the turbulent cases typically exhibit a primary vortex that continues to grow radially. This turbulent behavior is similar to that observed by Kubota et al., and implies that their descending disk flow is at least partially turbulent.

Jason DeGraw
Penn State University

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