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The effect of non-zero radial velocity on the impulse and circulation of starting jets MICHAEL KRIEG, KAMRAN MOHSENI, University of Florida — Vortex ring formation dynamics are generally studied using two basic types of vortex generators. Piston cylinder vortex generators eject fluid through a long tube which ensures a purely axial jet; whereas, vortex ring generators which expel fluid through a flat plate with a circular orifice produce 2-D jets (non-zero radial velocity). At the nozzle exit plane of the orifice type vortex generator the radial component of velocity is linearly proportional to the radial distance from the axis of symmetry, reaching a maximum at the edge of the orifice with a magnitude around 10 % of the piston velocity (the ratio of the volume flux and the nozzle area). As the jet advances downstream the radial velocity quickly dissipates, and becomes purely axial less than a diameter away from the nozzle exit plane. The radial velocity gradient in the axial direction plays a key role in the rate at which circulation and impulse are ejected from the vortex generator. Though the radial component of velocity is small compared to the axial velocity, it has a significant effect on both the circulation and impulse of the starting jet because of this gradient. The extent of circulation and impulse enhancement is investigated through experimental DPIV data showing that the orifice device produces nearly double both circulation and energy (with identical piston velocity and stroke ratios).

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