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The effect of entrainment on starting vortices GIUSEPPE ROSI, DAVID RIVAL, Queen's University — Recent work shows that vortex detachment behind accelerating plates coincides with when streamlines enclosing the starting vortex (SV) form a full saddle.[1] In the case of a linearly accelerating plate, it can be shown that vorticity-containing mass, and thus the SV's development scale with only dimensionless towed distance, while the SV's circulation scales with the acceleration rate. This results in shear-layer instabilities whose structure is Reynold-number independent, but whose strength scale with Reynolds number. It is hypothesized that the increased strength of the instabilities promotes entrainment, which causes the formation of the full saddle and thereby detachment to occur at an earlier dimensionless towed distance. To test this hypothesis, a circular plate is linearly accelerated from rest to pinch-off with chord-based Reynolds numbers of 10^3, 10^4, and 10^5 at the midpoint of the motion. Planar PIV data is acquired, from which FTLE and enstrophy fields are calculated. Vortex detachment is identified from the dynamics of the FTLE saddles, while the enstrophy fields are used to calculate both the vorticity-containing mass entering from the shear layer and the mass entrained from the quiescent surroundings.

[1]Rival, D. E. et al., *Exp. In Fluids*, 55:1660 (2014).

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