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The effect of aspect ratio on vortex rings within the wake of impulsively-started flat plates[1] JOHN FERNANDO, DAVID RIVAL, Queen's University — Vortex pinch-off has been the focus of many studies since it was first observed for vortices produced via piston-cylinder arrangements. Minimal work has been performed on other vortex generation methods. The current study investigates vortex rings behind impulsively-started circular, square, and elliptical flat plates. Preliminary force and PIV measurements show temporal/spatial similarities between vortex growth in the wake of the circular and square plates. Forces and vortex evolution are also shown to be strongly coupled; the presence of stable wake vortex rings results in a reduction of plate drag. For all three plates, pinch-off is initiated by the formation of a positive pressure gradient on the leeward side of the plate, which terminates mass transport to the vortex. It is hypothesized that an increase in aspect ratio (AR) from unity results in isolated vortex lines with non-uniform vorticity along the leading edges. Strong spanwise velocity gradients and stretching near the plate tips facilities vortex detachment. Results from experiments on rectangular plates with varying ARs are discussed and the effect of stretching and tilting in the tip region is investigated.

[1]The United States Air Force Office of Scientific Research

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