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Investigation of Half-Ring Vortices Generated by Half-Submerged Thin Circular Plate Using Digital Particle Image Velocimetry Method

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A half-ring vortex near the free surface interface of water can be generated by dragging a half-submerged thin circular plate in the fluid and quickly pulling it out. This results in faster moving water in front of the plate rolling over the slower water next to the plate and creating a vortex. This vortex tends to preserve its momentum which results in the vortex continually spinning and moving in the dragging direction. To investigate the ring's motions, the Digital Particle Image Velocimetry (DPIV) method is used to study the flow of the vortex. Glitter is used as tracking particles which follow the flow of the water. The relationships between the radii of the ring and the plate as well as the dragging and vortex speeds are derived. In addition, the vortex size and speed appear to not be constant over time. It can be deduced experimentally that this half-ring vortex behaves similarly to a full vortex ring generated by the motion of a fully submerged circular plate.

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