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**Portfolio Paper**

# Schlieren Visualization of Vortices and Internal Waves Generated by Vertical Stroke Oscillations of a Disk

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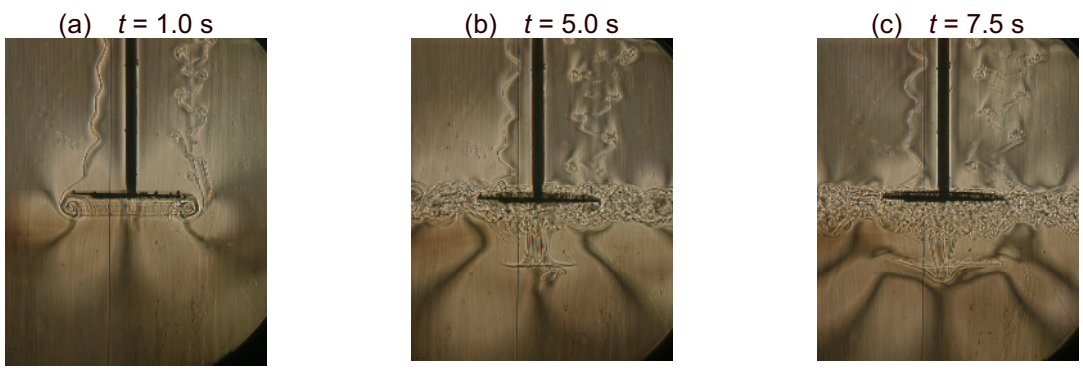


Fig. 1. Slit-thread schlieren images of flows induced by half-stroke of disk, $T_b$ = 7.25 s, $H$ = 3.1 cm.

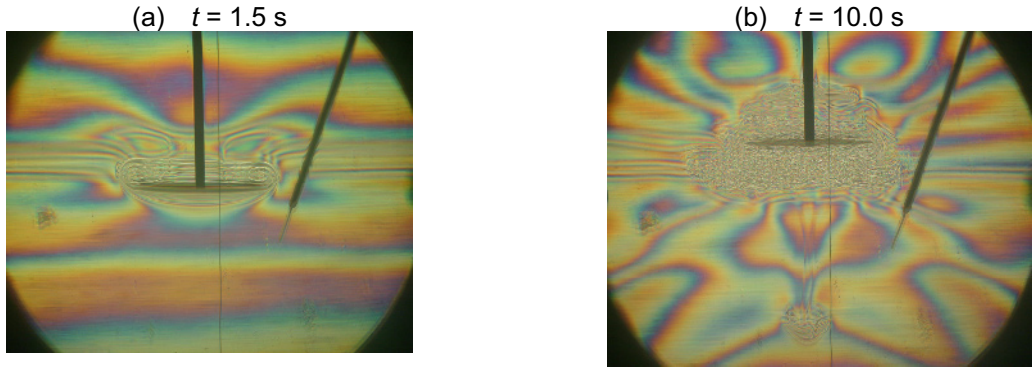


Fig. 2. “Natural rainbow” schlieren image of flow induced by stroke of disk, $T_b$ = 11.2 s, $H$ = 3.0 cm.

Side view of vortex flow induced by thin horizontal disk of diameter $d$ = 6.4 cm performing vertical oscillations with double-amplitude peak $H$ in a continuously stratified brine with the buoyancy period $T_b$ s is shown. Used schlieren methodsP[(1)] are “slit-thread in focus” and “horizontal grating in focus”[(2)]. Colouring of the image is caused by natural dispersion of light in the brine[(2)]. Diameter of view field is 23 cm. One half-stroke motion produces internal waves and central vortex only in the lower hemi-space. Thin curved lines above the disk are traces past ascending gas bubbles separated from the disk surface. Thin conical interface is formed directly inside the fluid and gradually retransformed in the mushroom-like vortex below the disk. Full stroke produces internal waves occupying the whole space and autocumulative jet that is mushroom-like vortex below the disk[(3)]. Autocumulative jet is formed inside the fluid and moves towards the disk. It’s tip acts as an additional instantaneous source of transient internal waves. Images of disk edge induced vortices are similar to downstream vortices past moving strip[(4)].

***References*** : (1) Heinzel, V. et al., J. of Visualization, 10-1 (2007), 9. (2) Chashechkin, Yu. D., J. of Visualization, 1-4 (1999), 345-354. (3) Chashechkin, Yu. D. and Levitskiy, V. V., J. of Visualization, 6-1 (2003), 59-65. (4) Chashechkin, Yu. D. and Mitkin, V. V., J. of Visualization, 7-2 (2004), 127-134.