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Geometry of compound vortex flow in cylindrical container produced by rotating flat or ribbed disc

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We study experimentally geometry of free surface deformed by compound vortex flow in a container. Experiments were set in cylindrical container partly filled with degassed water. The container is placed into rectangular tank to avoid optical distortion of flow pattern for sidewall photo and video registration. The flow is produced by uniformly rotating flat or ribbed disk coaxially placed at the container bottom. Control parameters of the flow are disk and container radii, fluid depth and frequency of the disk rotation. We have observed smooth, large scale disturbed and spiral waves deflected free surface deformed by compound vortex flow. The scheme of the flow is drawn. The shape of the smooth trough is calculated and compared with observed in experiment for different disks. Calculated and experimental shapes of the surface trough are in good agreement even in case the trough touches the surface of rotating disk. Critical conditions of formation of inertial and spiral waves are defined experimentally in a wide range of flow parameters and compared with theoretical values. Extrapolation of data on environmental conditions is discussed.