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Experimental investigation of free falling thin disks. Part I: The flow structures and the Reynolds number effects of zigzag motion CUNBIAO LEE, College of Engineering, Peking University, HONGJIE ZHONG — We present experimental investigations on the behaviors of free falling thin circular disk in still water. Flow patterns of the zigzag disk motion are studied with dye visualization and particle image velocimetry. Time-resolved disk motions with six degrees of freedom are obtained with a stereoscopic vision method. The flow separation and shedding vortices are found changing with free falling Reynolds number Re. At high Reynolds number, we found a new dipole vortices shedding from the disk besides the Karman-type vortices at low Reynolds numbers. The vortical structures are mainly composed of leading edge vortices, counter-rotating vortex pair and secondary trailing edge vortices. It was found that the dimensionless amplitude of horizontal oscillation was dependent on the Reynolds number Re. There existed a critical Reynolds number aboutß 2000, oscillatory amplitude was proportional to Re when Re is below the critical value, but invariant with Re when Re is above this value. The onset of dipole vortices was directly related to the increasing Reynolds number and horizontal oscillations.

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