Visualization of flow patterns past various objects in two-dimensional flow using soap film

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The analysis of the wake structure formed behind objects with different shapes, such as the recirculation region (wake bubble) and the vortex street formation shed at the trailing edge of a body – is a classical problem in fluid mechanics. Although many advanced experimental flow visualizations, such as particle image velocimetry or laser Doppler velocimetry, have been developed and used in fluid dynamics research, the use of flowing soap films has remained as an educational tool and economical visualization technique to study fluid-structure interaction and hydrodynamic instability in two-dimensional fluid flows.[1,2] Making use of the optical properties of the soap film and high-speed photography, the wake evolution and vortex patterns behind different bodies can be tracked and captured.

Following the description provided in Zhang *et al.*[1], the experimental setup consists of a specialized, continuously flowing soap film apparatus, having a test section of 1 m by 10 cm and capable of producing flows between 2.70 m/s to 6.50 m/s. The soap film in conjunction with the use of a high-speed pco.1200hs camera operated at a frame rate of 800 fps, as well as a low-pressure sodium lamp, produced images that highlight the interference patterns of the soap film, and illustrates how the wakes evolve within the flow. The photographs illustrated in Fig. 1 display the two-dimensional wake flow structure behind various objects from simple to complex geometries and arrangements. The wake generated from the interaction between the objects and the flow with different flow rates creates a number of artistic vortex patterns.

References

[1]J. Zhang, S. Childress, A. Libchaber and M. Shelley, “Flexible filaments in a flowing soap film as a model for one-dimensional flags in a two-dimensional wind,” Nature (London) **408,** 835 (2000).

[2]M. Beizaie and M. Gharib, “Fundamentals of a Liquid (Soap) Film Tunnel,” Exp. Fluids 23, 130 (1997).

Figure Caption

FIG. 1. Flow visualization using a flowing two-dimensional soap film, illustrating the flow dynamics in the wake of different geometrical objects and their arrangements.