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Rolling up with the flow to reduce drag: A numerical and experimental study inspired by leaves LAURA MILLER, CHRISTINA HAMLET, University of North Carolina, ARVIND SANTHANAKRISHNAN, Georgia Tech —
Flexible plants, fungi, and sessile animals reconfigure in wind and water to reduce the drag forces acting upon them. In strong winds and floodwaters, leaves roll up into cone shapes that reduce drag compared to rigid objects of similar surface area. Less understood is how a leaf attached to a flexible petiole (leafstalk) will roll-up stably in an unsteady flow. A combination of experiments and numerical simulation is used to describe the unsteady forces acting on flexible sheets attached to flexible beams. These flexible structures oscillate in steady and unsteady flow, and average drag forces are higher than those previously reported for flexible beams and sheets tethered to a rigid point. One important distinction between these models and the actual leaves is the ability to roll up into three-dimensional cone shapes. The experiments were repeated for flexible disks cut along a radius rather than rectangular sheets. The sheets reconfigured into stable cone shapes similar to leaves.

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