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Separated Flow Control with Actuated Membrane Wings JILLIAN BOHNKER[1], KENNETH BREUER, Brown Univ — By perturbing shear layer instabilities, some level of control over highly separated flows can be established, as has been demonstrated on rigid wings using synthetic jet actuators or acoustic excitation. Here, we demonstrate similar phenomena using sinusoidal actuation of a dielectric membrane wing. The effect of actuation on lift is examined as a function of freestream velocity (5-25 m/s), angle of attack (10°-40°), and actuation frequency ($0.1 < f^+ < 2$). By modulating the membrane tension, we demonstrate effective coupling with the separated shear layer, resulting in vortex roll-up and increased lift. Vortex shedding in phase with actuation voltage is shown with phase-averaged particle image velocimetry (PIV), as well as corresponding lift. Dynamic mode decomposition is used to show coherent vortex shedding in the flow field. Membrane kinematics are tracked using time-resolved direct linear transformation (DLT), and the vibration is shown to be dominated by actuation, rather than passive deformation. Finally, both the strengths and limitations of the current actuation mechanism will be discussed.

[1]Also affiliated with Naval Undersea Warfare Center, Division Newport

Jillian Bohnker
Brown Univ

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