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Characterization of Zero Mass Flux Flow Control of Airfoil Separation at Low Re NAN JOU PERN, RAY LEBEAU, JAMEY JACOB, University of Kentucky — Zero mass flux flow control using an oscillating upper wing profile is investigated at low Re over a NACA 4415 airfoil. Time-averaged particle image velocimetry (PIV) measurements over the suction surface shows that reduced frequencies of $F^+ \sim \mathcal{O}(1)$ using sinusoidal oscillations significantly reduces flow separation at Re ranging from 25,000 to 100,000. Phase-locked PIV at Re =25,000 is used to characterize the physical flow control mechanism. Preliminary visualization indicates that a vortex structure is formed at the point of separation and it travels downstream as the phase of the actuator increases. Detailed phase-locked PIV measurements of different phases of the actuation at Re =25,000 and F^+ ranging from 4 to 12 will be shown. It is expected that the vortex grows in size as it travels downstream and then dissipates. Comparison to and predictions from numerical simulations using an unsteady code with moving grid will also be presented.

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