Abstract Submitted
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Active concentration of vorticity along the leading edge of a semi-circular wing[1] DAVID WILLIAMS, JESSE COLLINS, Illinois Institute of Technology, TIM COLONIUS, California Institute of Technology — Leading-edge vorticity concentration plays a key role in lift enhancement for insect flight, swept wings on aircraft, and in unsteady flows through the formation of the dynamic stall vortex. Using 16 spatially localized pulsed-blowing actuators, we are able to concentrate the vorticity at the leading edge of a wing with a semi-circular planform. The experiments are done in a wind tunnel with a model chord Reynolds number of 68,000. Peak vorticity values double those of the unforced case result in an 80 percent increase in lift on the wing relative to the unforced post-stall lift. The semi-circular wing obtains lift coefficients approximately 35 percent larger than a rectangular planform wing with a comparable aspect ratio. The sweep of the wing's leading edge is believed to establish a spanwise transport of vorticity, contributing to the stabilization of the leading edge vortex. Closed-loop control of the wing plunging motion in an unsteady flow stream is demonstrated by modulating the strength of the leading-edge vorticity via a proportional-derivative controller.

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