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Study of Multiple Covert-Inspired Lift-Enhancing Flaps CHENGFANG DUAN, AIMY WISSA, University of Illinois at Urbana-Champaign — During high-angle attack operations, such as flying through gust or landing on a perch, a system of feathers known as the coverts is deployed passively. Coverts are referred to as nature's aeroelastic flow control devices. There are usually multiple rows of coverts on the suction side of a bird's wing. In this study, multiple covert-inspired flap rows were tested in the wind tunnel on a two-dimensional wing section at Re=2e5. Experiments were conducted at angles of attack (AoA) ranging from -4 deg to 46 deg. The multi-flap design included five flaps mounted on the suction surface of the NACA 2414 airfoil. During the wind tunnel tests, the flaps can either be activated to freely-move or be deactivated to stay closed. Lift improvements of up to 41% in the post-stall angle of attack regime were shown at AoA=20 deg for the five-flap configuration. A data-driven model was developed to show that each flap's lift improvement can be superimposed. The lift improvement due to the five-flap configuration is approximately equal to the sum of the lift improvements from each flap. The freely-moving flap angles were recorded during testing. Results presented in this study can help design new flow control devices for UAVs and shed insight into the role of the coverts during bird flight.

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