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**In-Flight Active Wave Cancellation with Delayed-x-LMS Control Algorithm in a Laminar Boundary Layer**<sup>1</sup> BERNHARD SIMON, Tech Univ Darmstadt, NICOLO FABBIANE, KTH Stockholm, TIMOTHEUS NEMITZ, Tech Univ Darmstadt, SHERVIN BAGHERI, DAN HENNINGSON, KTH Stockholm, SVEN GRUNDMANN, University of Rostock — This manuscript demonstrates the first successful application of the delayed-x-LMS (dxLMS) control algorithm for TS-wave cancellation. Active wave cancellation of two-dimensional broad-band Tollmien-Schlichting (TS) disturbances is performed with a single DBD plasma actuator. The experiments are conducted in flight on the pressure side of a laminar flow wing glove, mounted on a manned glider. The stability properties of the controller are investigated in detail with experimental flight data, DNS and stability analysis of the boundary layer. Finally, a model-free approach for dxLMS operation is introduced to operate the controller as a “black box” system, which automatically adjusts the controller settings based on a group speed measurement of the disturbance wave packets. The modified dxLMS controller is operated without a model and is able to adapt to varying conditions that may occur during flight in atmosphere.

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