Analysis and Wind Tunnel Testing of a SuperElastic Slat-Cove Filler for Airframe Noise Reduction

Master of Science Thesis Defense

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Abstract

During low speed maneuvers, such as landing and approach, a significant portion of the noise generated by transport aircraft is due to airframe noise. The leading-edge slat is a primary source of airframe noise. Previous work has shown that the slat-cove filler (SCF) is effective at mitigating the noise generated by the slat. The objective of this work was to further the development of a superelastic shape memory alloy (SMA) SCF concept using both computational and physical models.

Optimization of a structural model based on physical prototypes of the SCF was conducted considering SCF response to aerodynamic and slat retraction loads. A monolithic SMA SCF was found to minimize actuation force while satisfying constraints.

A combination of finite volume fluid models and finite element structural models based on a small-scale wind tunnel model of a conventional multi-element wing configuration with a SCF was used to develop an understanding of how the SCF behaved in flow. Wind tunnel testing of a physical model of the multi-element wing configuration was used to begin validation of the computer models.

William Scholten is an MS student in the Aerospace Engineering Department working under the supervision of Drs. Hartl and Strganac. He is an NSF fellow and started research on the SCF concept during his undergraduate degree. His research interests are in the areas of shape memory alloys and fluid-structure interaction. He is continuing his studies and pursuing a PhD at Texas A&M University.