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A HYBRID TRAILING EDGE CONTROL SURFACE CAPABLE OF CAMBER AND DECAMBER MORPHING

Ilhan Ozan Tunçöz, Yosheph Yang, Ercan Gürses, Melin Şahin, Serkan Özgen, Yavuz Yaman

Middle East Technical University, Department of Aerospace Engineering, Turkey
ozan.tuncoz@metu.edu.tr ; yosheph.yang@metu.edu.tr ; gurses@metu.edu.tr ; msahin@metu.edu.tr ; sozgen@ae.metu.edu.tr ; yyaman@metu.edu.tr

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Summary: This article presents the design and analysis of a novel hybrid trailing edge control surface that is capable to perform both camber and decamber morphings. The design is conducted with CATIA V5-6R2012 package program, and finite element analyses are performed with ANSYS Workbench v14.0 package program.

The control surface is composed of three different materials, and hence named as hybrid control surface. The main parts of the control surface are so-called "C Part", "Compliant Part" and "Rigid Part".

The C Part helps to connect the control surface to the wing. The skin parts are made of composite and C Bar part is made of aluminum. The servo actuators used to deflect the control surface are also attached to the C Bar. The C Part provides a sufficiently rigid support to the control surface.

The compliant part of the control surface is made of a silicon based material. This part always works in tension and the differential extension of the upper and lower portions results in deflection of the control surface hence, performing camber or decamber.

The so called rigid part of the control surface is made of composite and the remaining volume of the part is filled with foam material in order to increase the transverse stiffness of the control surface under the aerodynamic loadings. During the actuation the compliant part undergoes significant amount of deformations while the composite shows almost no strain hence only performs a rigid body motion.

The finite element modelling and analyses are performed for both in in-vacuo condition and under aerodynamic loading. The results indicate that the control surface is capable to perform both camber and decamber morphings. Various camber and decamber variations of the control surface are shown.

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