A HYBRID TRAILING EDGE CONTROL SURFACE CONCEPT

Pınar ARSLAN, Uğur KALKAN, Harun TIRAŞ, İlhan Ozan TUNÇÖZ, Yoseph YANG,
Ercan GÜRSES, Melin ŞAHİN, Serkan ÖZGEN, Yavuz YAMAN

Department of Aerospace Engineering, Middle East Technical University

Ankara, TURKEY

In this work the unconventional control surfaces of an unmanned aerial vehicle (UAV) is structurally analyzed. The UAV under consideration has morphing capabilities and the main focus of the work is the trailing edge control surfaces in particular. In the previous works, the authors have studied the unconventional aluminum control surfaces having open trailing edges. The activation of these control surfaces requires elastic bending of the aluminum skin that requires high servo-actuator forces and servo actuators. As a result of this requirement the unconventional control surface component normally becomes heavier than a conventional counterpart. In the current study, we propose a hybrid control surface concept consisting of both aluminum and a compliant material. Furthermore, the control surface has a closed profile at the trailing edge. The compliant material connects the aluminum part of the lower and upper control surfaces to the wing. Actuator forces will mainly stretch the compliant material while keeping the aluminum part almost without any elastic deformation. This is achieved due to great difference between elastic stiffnesses of both materials. Through the differential stretching of compliant materials in the upper and lower control surfaces; upward and downward motions of the control surface are achieved. Having obtained the desired motion of the control surface mainly by elastic stretching of the compliant material the required actuation forces will reduce considerably leading to lighter servo-actuators. The newly developed hybrid control surface will be tested against aerodynamic loads to show that it can safely carry these loads. Finally, a comparison of the required forces and weights of the proposed control surface with those of other unconventional ones will be made.

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