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Structural analysis of a composite target-drone wing

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Summary

Target-drone is an unmanned remotely controlled aerial vehicle and usually used for shooting training for anti-aircraft screws. Traditional target-drones have been generally manufactured from aluminum and/or wood. Recently, composite materials have been replacing them in virtue of their high strength-to-weight and stiffness-to-weight ratios. In particular, glass fiber-based composite materials are popular for the target-drone level vehicles because of the material cost and fabrication convenience.

In this paper, as a part of the development activities for a complete target-drone vehicle, the stress analysis results are presented for a 685cc engine target-drone composite aerial vehicle wing. Composite materials used are H612 and WR580A glass fabrics from HANKUK FIBER CO., LTD. Mechanical properties of these composite materials are experimentally determined using the coupon specimens made of the same fabrics and resin. For the wing analysis, two load cases are considered which are the 5g symmetric pull-up and -1.5g symmetric push-over. These load cases are also used in flight testing of a 1/2-scale vehicle. The 1/2-scale vehicle is to verify the flight performance of the preliminary design. MSC/PATRAN, Altair/HyperMesh and MSC/NASTRAN are utilized as the pre/post-processors and the solver, respectively. Margins of safety of the one dimensional elements are evaluated based on the static strength and the Euler buckling stress. Margins of safety of the 2-dimensional elements are calculated based on the Von-Mises stress. All structural parts are designed to have the positive margins of safety and it is verified by the static test of the prototype wing under about 6g symmetric pull-up condition.

keywords: Target-drone, Glass fabric, Composite material, FEM analysis

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