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STRUCTURAL ANALYSIS AND OPTIMIZATION OF A UAV WING

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Abstract: The use of unmanned aerial vehicles, also known as UAV's, are extremely useful on environmental operations such as on the measure of the gases emitted by a boat. By being controlled from a distant point, having a reasonable autonomy and an amazing agility, this kind of vehicles came to add an efficiency on the results of those operations. It is also a safer procedure where there are no human lives in danger. In this context, it is always needed better characteristics concerning the structure of the vehicles, namely the wings, which have a key role during the flight. The present study was developed with "UAVision" company, doing the structural analysis and topological optimization of the wing of one of theirs UAV´s. With this work, the main goals were the minimization of the mass, as also as the minimization of the maximum bending of the wing, to improve the autonomy of the vehicle and its flight stability. For this purpose, a program was built from scratch, using the commercial software ANSYS Mechanical APDL 18.1. A "bottom-up" strategy was chosen, creating small subsystems to reach a complex and final system, resulting in the 3D modulation of the wing. The topological optimization process was solved by Direct MultiSearch (DMS). DMS is a solver for multiobjective optimization problems, derivative-free and does not aggregate any components of the objective function. DMS maintains a list of feasible non-dominated points. At each iteration, the new feasible evaluated points are added to this list and the dominated ones are removed. Successful iterations correspond then to an iterate list changes, meaning that a new feasible non-dominated point was found. Otherwise, the iteration is declared as unsuccessful. The optimized wing was then manufactured for validation by experimental tests. The optimization process contributed to improve the performance of the wing in more than 25% when compared to the non-optimized wing.