GLOBAL OPTIMAL DESIGN OF TWO AEROSPACE VEHICLES

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Abstract: The new projects of suborbital tourist flight need two global optimized (GO) aerospace vehicles, namely: a greater geostationary (GEO) vehicle and a smaller suborbital one (LEO), which up and go of GEO . Both aerospace vehicles shall be of minimum drag, at two different cruising Mach numbers namely, 2.2 and, respectively, 3. The determination of a global optimized (GO) shape of a flying configuration (FC) (namely the simultaneous optimization of its distributions of camber, twist and thickness and also of the similarity parameters of its planform) leads to an extended variational problem with free boundaries The discontinous surface of an elitary FC is picewise approximed in form of two different superpositions of homogeneous polynoms in two variables, one on the wing and the other on the fuselage. The coefficients of these polynoms, together with the similarity parameters of their planforms, are the free parameters of optimization. An own iterative optimum-optimorum strategy was developed, in order to determine the GO shape of a FC, inside of a class of elitary FCs (optimized with fixed planforms). In the first step of iteration, own developed three-dimensional, hyperbolic potential solutions are used as start sölutions for the optimization A lower limit hypersurface of the inviscid drag functional, as function of the similarity parameters of the planforms of elitary FCs of the class is defined and the elitary FC, which corresponds to the minimum of this hypersurface is, in the same time, the inviscid GO FC of the class. This inviscid GO shape of FC, is used as surrogate model and its friction drag is computed. Up the second step of iteration, the own developed hybrid Navier-Stokes solutions are used as start solutions for the optimization and the new functional is the total drag, including friction. This strategy is applied for the determination of the GO shapes of both aerospace vehicles, optimized at cruising Mach numbers M=2.2 and respectively M = 3. They fly shock free, without sonic boom interferance and, due to their GO shapes, have high values of L/D (lift to drag), at their cruises.