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Calculation of the Supersonic Air Intake with the Optimization of the Shock Wave System

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Abstract : During the flight of a supersonic aircraft under various conditions (altitude, Mach, etc.), it becomes necessary to coordinate the operating modes of the air intake and engine. On the supersonic aircraft, it's been done by changing various control factors (the angle of rotation of the wedge panels and etc.). This paper investigates the possibility of using modern optimization methods to determine the optimal position of the supersonic air intake wedge panels in order to maximize the total pressure recovery coefficient. Modern software allows us to conduct auto-optimization, which determines the optimal position of the control elements of the investigated product to achieve its maximum efficiency. In this work, the flow in the supersonic aircraft inlet has investigated and optimized the operation of the flaps of the supersonic inlet in an aircraft in a 2-D setting. This work has done using ANSYS CFX software. The supersonic aircraft inlet is a flat adjustable external compression inlet. The braking surface is made in the form of a three-stage wedge. The IOSO NM software package was chosen for optimization. Change in the position of the panels of the input device is carried out by changing the angle between the first and second steps of the three-stage wedge. The position of the rest of the panels is changed automatically. Within the framework of the presented work, the position of the moving air intake panel was optimized under fixed flight conditions of the aircraft under a certain engine operating mode. As a result of the numerical modeling, the distribution of total pressure losses was obtained for various cases of the engine operation, depending on the incoming flow velocity and the flight altitude of the aircraft. The results make it possible to obtain the maximum total pressure recovery coefficient under given conditions. Also, the initial geometry was set with a certain angle between the first and second wedge panels. Having performed all the calculations, as well as the subsequent optimization of the aircraft input device, it can be concluded that the initial angle was set sufficiently close to the optimal angle.

Keywords : optimal angle, optimization, supersonic air intake, total pressure recovery coefficient
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