Problem of optimisation of the transport aircraft nacelle damper assembly

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Introductions. In connection with the development of aircraft construction, the problem of calculating the stress-strain state and solving the problem of weight optimisation of nacelle fasteners for single-engine transport aircraft is relevant. Today, various models, including computer models, are widely used in strength calculations. A computer model of a complex system should reflect as fully as possible all the main factors and interrelationships that characterise real loads [1-3]. Today, computer modelling of mechanical systems is widely used in mechanical engineering, so it is

advisable to use computer modelling methods to calculate the strength and reliability of important structural elements of an aircraft.

Aim. Due to the development of aircraft construction, the problem of calculating the stress-strain state and optimising the damper assembly of an aircraft nacelle is of great importance.

Materials and methods. The nacelle attachment element is a damper assembly that secures the upper nacelle cowl to the U-bar. It is possible to reduce the weight of the damper by changing the geometric model of the damper body. All other parts of the damper assembly cannot be changed. The loads absorbed by the damper assembly were obtained by modelling flight conditions and overloads accompanying the flight. The damper body receives loads from the stem. The loads are in the form of distributed pressure, which is variable along the length of the tubular eye. In this work, the stress-strain state of the damper body was determined, which consists of the following elements: sole, tubular eyelet, and stiffener. The calculation of the stress-strain state for the geometric model of the housing was carried out by the finite element method in the MSC.Patran software package.

Results and discussion. To build a finite element model of the damper assembly, a tetrahedral finite element was used, and Beam and RBE2 elements were used to model the bolting of the hull (Fig. 1). The Beam element has the form of two nodal beams of circular shape with a radius R = 3 mm. The RBE2 element is used to model the behaviour of the casing under the bolted connection washer. After obtaining the calculated data in the form of Mises stress fields (Fig. 2), we found the zones in which it is advisable to change the geometric model in terms of weight optimisation.

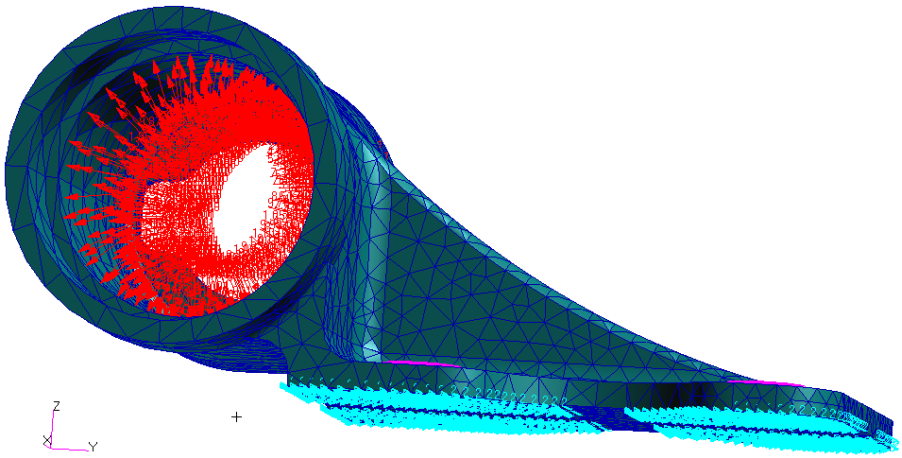

Figure 1. Finite-dimensional model of a damper assembly

Based on the calculation data, the optimal model of the damper assembly housing was determined.

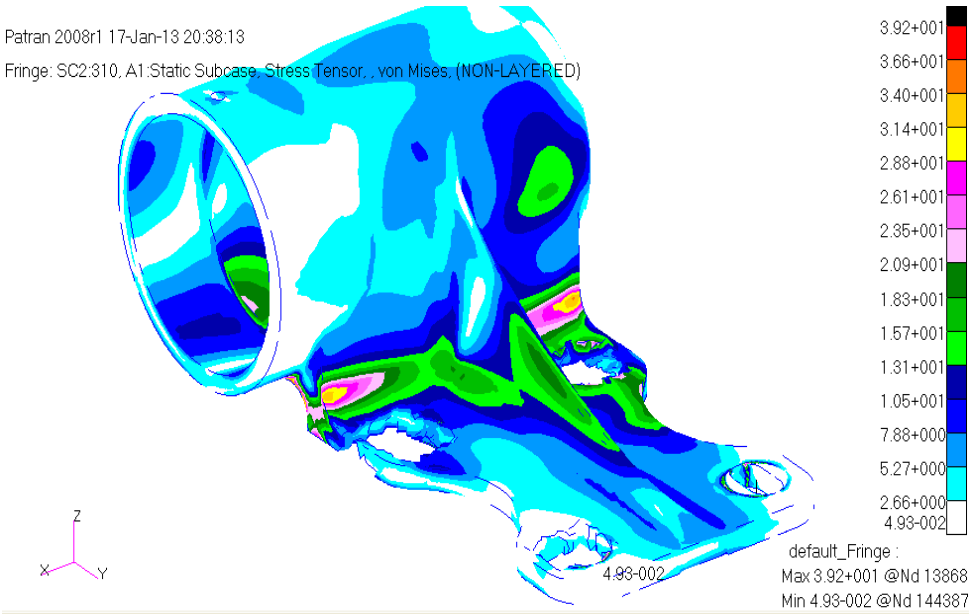

Figure 2. Mises stress distribution (MPa)

Conclusions. In this paper, we have calculated the VAT for the damper body of a single-engine transport aircraft. When performing the weight optimisation of the damper body, three lightweighting options were considered, of which the most rational one was chosen. For this variant, a full calculation of the stress-strain state was performed in the MSC.Patran software package.

Literature

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