UDC 539.3

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METHODOLOGY FOR SELECTING RATIONAL MATERIAL DISTRIBUTION FOR STRUCTURAL THIN-WALLED ELEMENTS

The work goal is to analyze the recent developments in the field of the methodology for selecting a rational distribution of the material for structural thin-walled elements. Based on the solution of the optimization problem, the method is examined using the Pontryagin maximum principle with general limitations. Using mathematical modeling, this method allows the creation of the middle-complexity structures with high specific strength and the reasonably good straining properties. A golography technique is also used to measure the parameters of the rigidity and strength characteristics of shell- plate structures under optimization with their modelled and full-scale samples. The results are descriptive with reasonable accuracy. An experimental and calculating approach used improves the parameters of the structures with more complex configurations, material and load distributions because the measurement of their stressed-strained state is not sufficiently reliable using computations. Their effectiveness is illustrated by examples of the analysis of a redistribution of the material of a cylindrical shell and ribbed plate exposed to a normal surface force, a gear case and a clutch. A concept of an advanced approach to a rational distribution of the material for specifically complex-shaped body structures is proposed. The developments presented enhance the class of the structural thin-walled elements for modern engineering and structures using a high- level design of the rational parameters.

Keywords: *structural thin-walled elements, rational distribution of material, Pontryagin maximum principle, holography interferometry.*

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