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Strength Analysis and Stiffness Characteristics of the Hollow Parts (Shaft Type)

It is evident that in the heavy engineering material costs can be up to 50-70% of the cost of manufacturing. Taking into account the limited resources and the development of world market prices for raw materials, the questions become increasingly material savings to the national economy.

Weight is most important in transport engineering, especially in aviation, where every extra kilogram reduces payload capacity, speed and range. In general engineering downsizing machines means less material consumption and decreasing manufacturing costs.

The aim of this research is to maintain the strength characteristics of parts while reducing weight with parallel reduction of metal, giving equal strength and determination of rational sections and shapes, suitable strength of the materials used, the use of durable materials, rational construction schemes, eliminating unnecessary safety margins, and replacing metal by nonmetallic materials.

Designing round profiles (shafts, axles, and other cylindrical parts) play a great interest for engineering. The main way to reduce the weight of parts is the removal of metal from the lightly loaded center section that is, i.e. giving the annular shape.

Therefore, the strength characteristic of the obtained dependence of the wall thickness of the annular section is of a particular interest. For better clarity and instead of wall thickness we suggest using the following relation:

$$a = \frac{d}{D},$$

where D - outer diameter of the shaft;

d - diameter of the hole.

In this regard, the relations between the parameter of strength characteristics have been used to investigate necessary parameters.

Specific dependence of massive and hollow sections in bending and torsion has been examined in several cases. The analysis of produced dependency shows the advantages of hollow sections.