STATISTICAL ANALYSIS OF THE PROBABILISTIC SPHEROIDAL GRAPHITE CAST IRON YIELD SURFACE PROBABILITY CHARACTERISTICS

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The cast iron at the micro-level has a heterogeneous structure that exhibits variability at various material points. An anisotropic materials yield surface describes the behavior of a structure under a complex stress state. An alternative to direct research methods is computer simulations, which are used to predict the materials conduct. The information obtained during the study helps to prevent the destruction of critical components and structures.

This work is aimed at evaluating the impact of the concentration of spherical inclusions on the state of the yield stress under tensile and compressive loading. Such analysis implies the creation of an experimental set of yield surfaces to ensure the absence of plastic deformation.

To create the microstructure of cast iron, a method of artificial structure generation is applied. The location of the inclusions radii centers are followed to a uniform distribution, and their size corresponds to the normal distribution function of concentration. The finite element method is using to describe the stress-strain state. The hypothesis of the maximum distortion energy theory is introducing for a description of a multidimensional stress state in which the yield surfaces are located.

The line intersects the graph of the yield surface to evaluate the statistics. Analysis of the yield surface probabilistic characteristics shows the influence of the concentration of inclusions on the material strength characteristics. According to 3-sigma rule, a spread for stress under tension and compression is considered. With an increase in the model inclusions concentration noted of the, decrease in stresses and their spread for both states under compression and tension. For example, a spread for stress under tension σ_{yield} = 3.0879±0.3904 *MPa* for the smallest considered concentration (ψ = 0.055), which is decreases to σ_{yield} = 2.7103 ±0.3411 *MPa* for the greatest one (ψ = 0.300).

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