METHODOLOGY FOR THE DEVELOPMENT OF A MODEL FOR MANAGING THE QUALITY AND PRODUCTIVITY OF SHAPING WHEN PROCESSING HARDENED COARSE-MODULAR GEARS

DrS., Prof. V. Kovalov, DrS., Prof. Y. Vasylchenko, Candidate of sciences, M. Shapovalov, Donbass State Engineering Academy, Kramatorsk, candidate of sciences, O. Antsyferova, Graduate student, K. Kamchatna-Stepanova, NTU "KhPI", Kharkiv

The variety of mechanical methods of gear processing of cylindrical gear wheels makes it possible to develop scientific directions for increasing the productivity, accuracy and quality of gear processing of hardened large-modular gear wheels by ensuring the required parameters of the surface layer of the processed gear wheels, which determine their operational properties.

To ensure optimal durability and reliability of the operation of cylindrical gears, it is necessary to give their machined surfaces substantiated geometric characteristics and physical and mechanical properties. The operational properties of gears at the manufacturing stage depend on the processing accuracy, the grade of the material, its structure and hardness, as well as the roughness of the surfaces, depending on the method or method of their production. The studies carried out show that the surface roughness of hardened coarse-modular gear wheels of the same accuracy and height can have different operational properties [1]. Surfaces with the same precise surface may have different degrees of work hardening, unequal character and magnitude of residual stresses, different degrees of distortion of the crystal structure and the degree of violation of the surface integrity due to microcracks, scoring, and loosening.

When machining hardened coarse-modular gears, the surface layer undergoes plastic deformation and local short-term heating. Residual stresses appear in this layer, which are significant (Figs. 1 and 2).

Technological support of the operational properties of hardened large-modular gear wheels is determined by the solution of two problems: first, the choice of materials, the hardness of the working surfaces of the teeth and the purpose of the dimensional accuracy and the system of parameters of the state of the surface layer, which should provide the required operational properties; secondly, the choice of the method and the purpose of the processing modes that provide the most economical and reliable achievement of the specified dimensional accuracy and the system of parameters of the state of the surface layer of the processed hardened coarse-modular gear wheels.

Thus, the wear resistance of hardened coarse gears is characterized by the complex state of the friction surfaces.

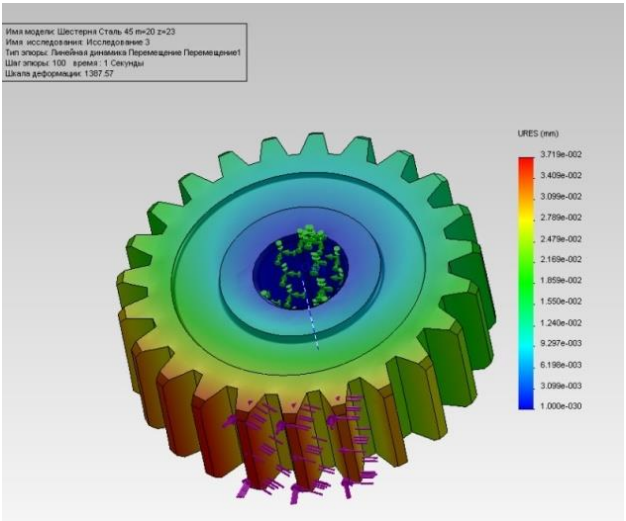

Fig. 1 – Occurrence of residual stresses in the surface layer under dynamic loading

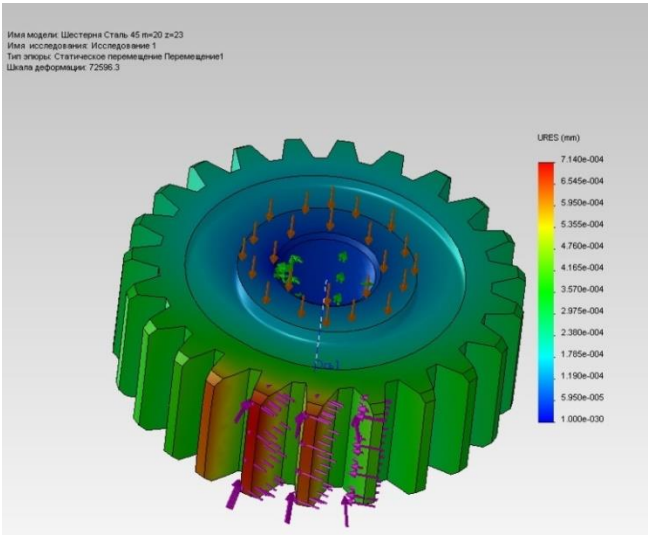

Fig. 2 – Occurrence of residual stresses in the surface layer under static loading

The load-bearing capacity of the surface of hardened coarse-modular gear wheels, the intensity of wear during sliding friction, along with roughness, are determined by macrodeviations, waviness, and physical and mechanical properties (microhardness and residual stresses).

Therefore, the resulting roughness of the friction surfaces during the running-in process will depend on the remaining parameters of the state of the surface layer of the contacting parts. Consequently, the achievement of an equilibrium state of the surface layer of hardened coarse gear wheels in engagement is possible with the implementation of an elastic contact of interacting bodies.

References: 1. *Morivaki T.* Combined stress; material flow and heat analysis of orthogonal micromachining of copper / *T. Morivaki; N. Sugimura; S. Luan* // Annals CIRP. – 1993. – N 42/1. – P. 75–78.