

Dynamic characteristics and monitoring of rubbing surfaces quality

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Abstract

This paper is devoted to identification of dynamics of cyclic wearing process. The experimental realization of the problem has been carried out with the use of an original tribometrical system "Tribal-2". The drive of the system allows to realize a reciprocating displacement of tested samples with a regulated speed of movement. Unpercussive normal loading is carried out with the help of feedback based on difference in phases of entrance and target signals. Signals' numbering is carried out with the use of computer technologies. "Tribal-2" is focused on a possibility of soft and rigid loading; on cyclic modes of preliminary displacement, and on slipping with friction wearing process. "Tribal-2" is equipped with a special set of thermographs and a number of applied programmes on MATLAB. All original components of the installation have been patented. The results of research of the circuit of contact interaction coupling slipping under rigid loading have been obtained. In the offered method of data processing a process with one input and several outputs has been considered. The use of similar approaches allows to receive transfer functions of friction - wearing process. The theoretical substantiation of the method is based, firstly, on research of dynamics of levelling of the initial pressure curve during friction - wearing process; secondly, on the problem solution concerning fretting surfaces' form evolution. Thirdly, on the research of evolution's transient process. It has been established, that aperiodic element is in correspondence with an initial stage of wearing process, and the authors have taken that fact into consideration for description of wearing process' kinetics. As far as we know, that at the initial stage the quality of contacted surfaces is worse than at subsequent stages, the authors offer to use this dynamic characteristic as the bottom border of quality. As numerous experiments with metal and glass have shown, the final stage of surfaces' processing is in correspondence with oscillatory element without damping (doubling of amplitude) and this dynamic characteristic has been used as the top border of quality. An oscillatory element with damping is used for an operative estimation of processed surfaces' quality at intermediate stages. Practically, with the help of "Tribal-2" we

can have a reliable monitoring of rubbing surfaces' quality in a real time mode. Perhaps, it is the most important difference from other methods of surfaces' processing with the usage of programmed ways of frictional force and pressure distribution on different detail's zones with the help of elastic tool. The "Tribal-2" system allows us to investigate dynamics and kinetics of the third body. In conclusion, it has been shown, that dynamics' equation is in correspondance with Bessel's equation and the first integral reflects its kinetics. Appropriate dissipative functions have been constructed and profilogrammes have been measured at all stages of the investigation and laser scanning of surfaces' topography has been carried out. All data have been processed with the help of fast Fourier transformations and their wavelet analysis have been carried out too. The results of the analysis have been also submitted for consideration.