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VIBRATION ANALYSIS DURING ROOT MILLING OF PARTS

In the process of machining the parts by cutting, vibrations occur that degrade the quality of the machined surface, increase tool and machine wear, and lead to misalignment of joints in the machine and devices. Vibrations accompany any physical process. But attention is paid to them only when their intensity leads to undesirable results. Strong vibrations cause a decrease in the productivity of the cutting process, and sometimes work on the machine becomes impossible at all.

Vibrations arise under the condition that the oscillatory system is given energy when it is removed from the equilibrium position.

Vibrations occurring due to the internal forces of the system are called free vibrations. Vibrations, as a result of the impact of a periodic perturbing force on the system, cause forced vibrations.

When processing, self-oscillations may occur – vibrations without a periodic action of a driving force. That is, these are vibrations in which energy losses are replenished due to a periodic influx of energy from a source that does not have oscillatory properties. This type of vibration is the most complex and its intensity is influenced by the type of metal being processed and its mechanical properties, cutting modes, geometric elements of the cutting part of the tool, and the rigidity of the machine-tool-part system.

A distinctive feature of milling is the interrupted cutting process. In the tool-part system, vibrations that are excited are observed in various elements: free vibrations, forced vibrations due to the periodic nature of the change in cutting forces that are associated with the cutter tooth getting in/out of the allowance, as well as self-oscillations. Self-oscillations during milling arise due to excitation during cutting of the surface formed during the previous pass of the cutting edge of the tool. The system oscillations

occur at a frequency different from the frequency of pass of the cutting edges and tending to one of the natural frequencies of the system. Vibration amplitudes turn out to be significant, so vibrations lead to a significant increase in cutting forces and a decrease in the quality of processing.

Currently, milling of parts from various types of materials is performed at cutting modes, which are usually selected experimentally, taking into account the level of emerging vibrations and their effect on productivity, tool life, dimensional accuracy and surface quality. There are known traditional means to reduce these vibrations. However, there are many unresolved issues that are currently important and require additional consideration and research.