USING OF ACTIVE CLAMPING DEVICE FOR WORKPIECE VIBRATION SUPPRESSION

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Vibrations, which always appears in machine tool - cutting process dynamic system (MT-CP) are very undesirable. Their negative influence on productivity, tool life and surface quality is well known. This fact causes that new methods of counteracting of this phenomenon are still developed and improved. Vibration amplitudes depend on dynamic properties of the machine tool, the cutting tool, the work-piece and machining parameters. Properties of the machine tool are usually intentionally shaped by the producer, to allow stable operation in the wide range of machining parameters. However in the case when the work-piece exhibits very low stiffness the probability that the system becomes unstable is very high. The start point of presented investigations was the statement, that work-piece is responsible for loosing stability of dynamic MT-CP system and the uncontrolled self-excited vibration can develop to an unacceptable level. The chatter vibration is generated mainly by the wave regeneration effect. In the paper the method of counteracting chattering through application of an special work-piece clamping system is presented. The idea is to use active elements in the work-piece holder construction. This allows to modify dynamic properties of the work-piece and actively control of its vibration. In this work piezo actuators are used as active elements. The controller based on the displacement measurement is used to shape the dynamic characteristic of the machine tool - cutting process system. Thus the damping factor in the vicinity of natural frequencies is significantly increased and the stable machining can be achieved at higher cutting parameters. The model of the active clamping system with a fixed work-piece is presented in the paper. Numerical simulations for different cutting parameters were conducted. In all cases the lower vibration amplitude ware observed in comparison to the machining without using active clamp system. The time plots of selected signals are presented for machining of a work-piece sample. The experimental validation of proposed solution was conducted for wide set of machining parameters (spindle speed, feed rate and depth of cut). Experiment was executed on DMU 60 Monoblock milling machine with the laser measurement system.