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AUTOMATED CONTROL OF STANDARD TIME FOR THE PROCESSING OF THE PRODUCTION OBJECTS IN DRILLING PROCESS

Modern production, organized as a flexible manufacturing system (FMS) provides for the use of automated manufacturing equipment, including machine tools with numerical control (CNC). An important problem that arises in the implementation processes on machine tools with CNC is automated control of standard time, spent for processing of production objects (PO) on drilling machine. The indicated conditioning the fact that the standard time is the basis for remuneration, calculating the cost of finished products, the duration of the production cycle, the required number of machines, tools and workers, as well as production planning in general.

Time standardization is setting technically feasible consumption rates of production resources. As so it is accented so-called technical standard time (TST), which is the amount of work that needs to be spent on processing of the single PO or executing a unit of work on certain manufacturing operations (MO) with the most efficient use of all means of production. Irrational use of TST leads to a significant increase in unit cost, which in turn can cause significant economic losses for the company.

Standard time, and its calculation specifics depends on the organization of production, but in general, the rate of time can be represented by the expression: $TST = tpe + top + tm + tre + tpt$ where TST - standard time per unit; *tpe* - preparatory and final time; *top* - operative time; tm - time for maintenance work; *tre* - time to rest and personal needs; *tpt* - breaks caused by technology and manufacturing process.

The components of the operational time are the main tm and auxiliary ted technological time. Moreover cost analysis for components of operational time top showed that control of standard time TST when performing drilling process can be made affected by the length of the main technological time tm.

Analysis of factors affecting the length of main technological time tm formally describe connection of TST for processing of PO to its physical, mechanical, structural and technological features, and characteristics of the process as follows: $tm \rightarrow \{PO; TO; F\}$, where tm - main technological time that is defined in the operational process of the machine; PO - parameters describing PO, which are processed on drilling machine, for example, material of PO, PO design features (grooves, coots, trims, etc.) diameter pretreated bores in deep bore drilling; TO - technological parameters of technological operation for drilling process, for example, the length of the working stroke, the number of cutting tool movements, its diameter, material, blunting, design features of the drilling machine; F - set of disturbances, such as deficiency of PO (material or discrepancy of surface layers for PO), the deficiency of tools (inadequate quality of material or coating of cutting tool), blunting of the cutting tools. Defining the set of typical disturbances allows synthesizing a set of solutions (G), which should inform the operator to minimize the length of the main technological time. These solutions include: replacement of cutting tools, quality control of PO, cutting tool sharpening and enabling cooling.

Said above allows to synthesize structural model of standard time control system (STCS) shown in Figure 1. The input STCS gets operational data describing the characteristics of PO TO, which arrive into the data base, in which current data from various sensors is gathering and stored previous fata with the time to which they belong, after which all data is brought to a common format and consistent. The most important component of system is data mining. performed in three steps: 1) search for patterns in connection of the length of the main technological time *tm* with characteristics of PO and TO; 2) usage of indicated patterns in predictive modeling for the length of main technological time *tm*; 3) analysis of exceptions to detect and identify anomalies in predicted length main technological time *tm* that can detect and identify deviations from the TO of drilling, which should be reported to the operator.

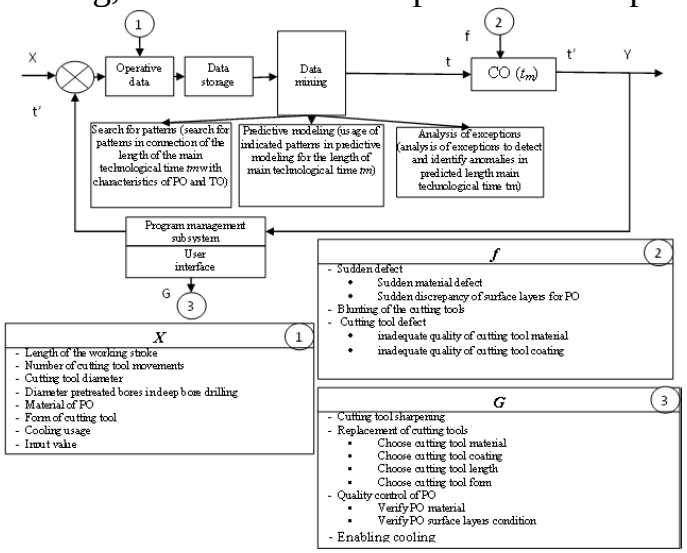

Fig.1. Structural model of STCS for drilling TO

The resulting predictive value for length of main technological time *tm* l and messages of need to intervene in TO of drilling by operator, is notified via user interface controlled by program management subsystem. In program management subsystem stored data base for decisions, which must be informed to the operator when presence of abnormalities is detected and made decisions about the need for issuing messages to the user interface. Thus the proposed STCS is enhancing the quality of decision-making by operator in time normalization for drilling process.