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Setting of the Normal Lathes Operational Reliability

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Abstract

The analysis of the machine – tools produced in the last years reveals that their development tendencies are oriented in the direction of the productivity increasing and of the processing accuracy.

The paper presents a modality of establishing operational reliability of the normal lathe having as calculus criterion the decreasing of made parts execution accuracy.

Key words: *normal lathe, mechanical processing, operational reliability*

General Principles

In defining the machine – tools reliability it has to be taken into account two issues [2]:

- The conditions imposed to an working machine (aspect related to the complexity of a machine – tool construction and to the way of their reliability systemic approach);
- The reliability as a component of quality (reliability is quality over time).

The maintaining of the machine – tools processing precision characterizes the possibility of keeping precision indices as a result of the deposit, transport, installation and exploitation of the machine – tools. In order to determine this index it is necessary to analyze all factors that influence on the modification of the machine – tools parameters in time, determining the precision loss and evaluating the functioning period in which the machine – tool assures a processing precision within the tolerance field.

In these conditions, it results that a necessary condition for determining the operational reliability of the machine – tools is to be established an eligibility criterion to monitor the decreasing in time of the working precision [2].

Elaboration of the Working Model

In the mechanical machining technological processes, the system structural elements are conditioned by the generation of the machine – tools surfaces: shape changing, dimensions, relative positions, aspect of the surfaces that comprise the processed [1].

The working precision of the machine – tools is strictly related to the wear of the elements that assure the relative movements' precision between part and the cutting tool (guides, main shaft, lead screw, gears etc.).

The precision of the mechanical working is influenced by two main errors categories [1] (fig. 1):

- Errors that do not depend by the machine – tools loading;
- Errors that depend on the machine – tools loading.

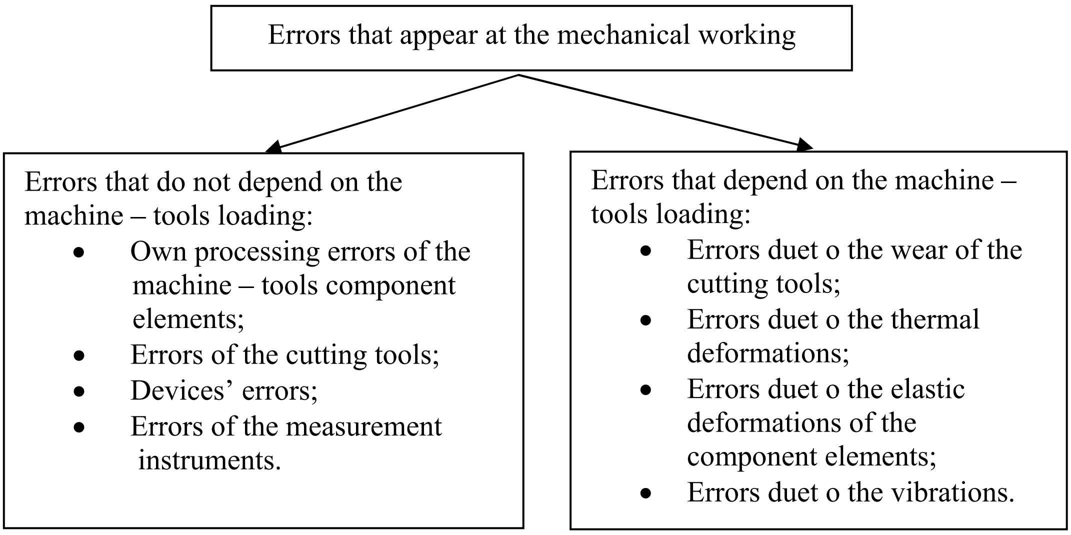


Fig. 1. Errors that appear at the mechanical working.

In the case of the normal lathes, it may be accepted as operational reliability calculus criterion the spreading filed of the errors in the longitudinal section of the worked piece (cilindricity deviation) [2].

According to STAS 12030-85, at the normal lathes' reception, the checking of the working accuracy is made by direct measurements made on sample parts processed with a finishing system. The verification made refers to the establishment of cilindricity deviation that has to be within the limits specified in the standards.

Test Program

The study made was realized by testing a normal lathe SN 400×1500, equipment found in the Department of the Manufacturing Technology and Industrial Management, machine cut mechanical working lab.

The shape and the dimensions of the worked parts were according to STAS 12030-85 (table 1).

The recommended working regimes are those of finishing:

- The cutting regime parameters are: n = 1400 rot/min, a_p = 0.2 mm and the working feed f = 0.09 mm/rot;
- There is processed by turning the sample having the shape and the dimensions from the table 1 with a knife with cemented – carbide tip P10 STAS 351 - 86, having $\chi = 45^0$, $\chi_1 = 15^0$, $\gamma = 6^0$, $\alpha = 3^0$, r = 0.5 mm.

Experimental Determinations

Each part was processed at different periods of time (specified in table 2) and there were calculated the deviations at cilindricity. The obtained results are presented in the table 2.

Table 1. Shape and dimension of the worked parts.

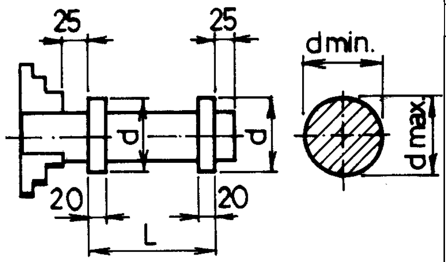
No.	Verification object	Verification scheme	Tolerance (mm)	
			Precision class	
			Normal (N)	
			$D \leq 800$ mm	$800 < D \leq 1600$ mm
0	1	2	3	4
P1	Circular shape of the section and the cylindrical shape of the worked part: a) circularity b) cilindricity	According to STAS 12030-85  L = 300 mm	a)	
			0.01	0.015
			b)	
			0.02	0.03

Table 2. Registration of the experimental data.

No.	Working time till measurement *t* (h)	Measured deviation y (mm)	No.	Working time till measurement *t* (h)	Measured deviation *y* (mm)
0	1	2	3	4	5
1	10440	0.010	19	12650	0.018
2	10456	0.014	20	12720	0.016
3	10472	0.012	21	12890	0.012
4	10490	0.012	22	12948	0.016
5	10628	0.014	23	13110	0.016
6	10728	0.014	24	13245	0.012
7	10822	0.016	25	13376	0.018
8	10943	0.014	26	13470	0.016
9	11240	0.018	27	13510	0.016
10	11366	0.020	28	13634	0.014
11	11428	0.014	29	13720	0.018
12	11504	0.012	30	13870	0.014
13	11620	0.010	31	14125	0.014
14	11720	0.012	32	14355	0.016
15	11834	0.018	33	14472	0.016
16	12100	0.014	34	14560	0.018
17	12260	0.012	35	14680	0.018
18	12450	0.016	36	14920	0.018

The variation of the measured deviation y (mm) depending on the working time till measurement t (h) is presented in the figure 2.
Using the method of the least squares there is obtained the dependency:

$$y(t) = 0.00000024 \cdot t + 0.01494 \quad (1)$$

The average working time T_m is determined by the admissibility criterion established by standard (table 1):

$$y(t) = T_{adm} \quad (2)$$

where T_{adm} represents the admissible tolerance, $T_{adm} = 0.020$ mm according to STAS 12030-85.

In these conditions there is obtained: T_m = 2108 h (approximately 263 working days on 8 hours).

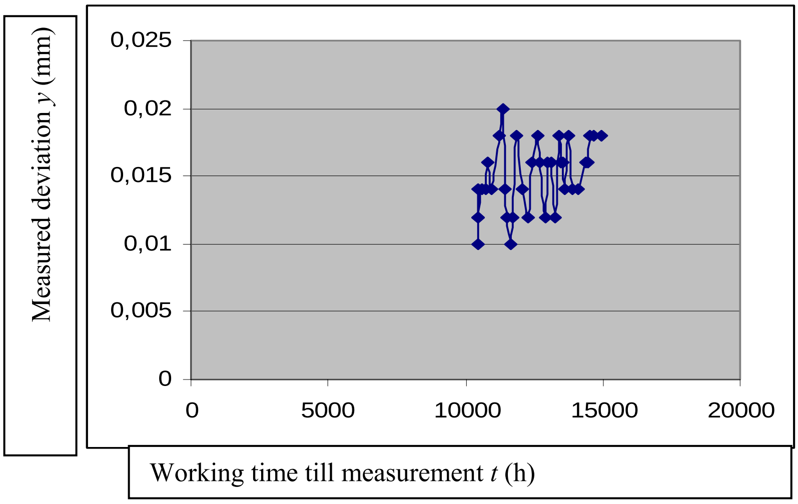


Fig. 2. Dependency $y = f(t)$.

Conclusions

The increasing complexity of the mechanical working technical systems (numerical control machine - tools, machinery, machining centers, processing flexible systems etc.), intensification of the working condition, increasing of the working accuracy, specification of a generated surface higher quality, their high degree of implementation make their reliability study to gain more and more importance.

The proposed method in this paper allows establishing the proper working average time on the basis of an admissibility criterion of the working errors in order to verify the normal lathes work accuracy.

References

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2. Oprean, A., et al., *Fiabilitatea maşinilor-unelte*, Editura Tehnică, Bucureşti, 1979.

Stabilirea fiabilității operaționale a strungurilor normale

Rezumat

Analiza maşinilor-unelte fabricate în ultimii ani relevă că tendinţele de dezvoltare ale acestora sunt orientate în direcţia măririi productivităţii şi a preciziei de prelucrare.
Lucrarea prezintă o modalitate de stabilire a fiabilităţii operaţionale a strungurilor normale având drept criteriu de calcul scăderea preciziei de execuţie a pieselor confecţionate.