MODEL OF THE SYSTEM OF AUTOMATIC MANAGING WITH THE GRINDING PROCESS OF Ti ALOYS

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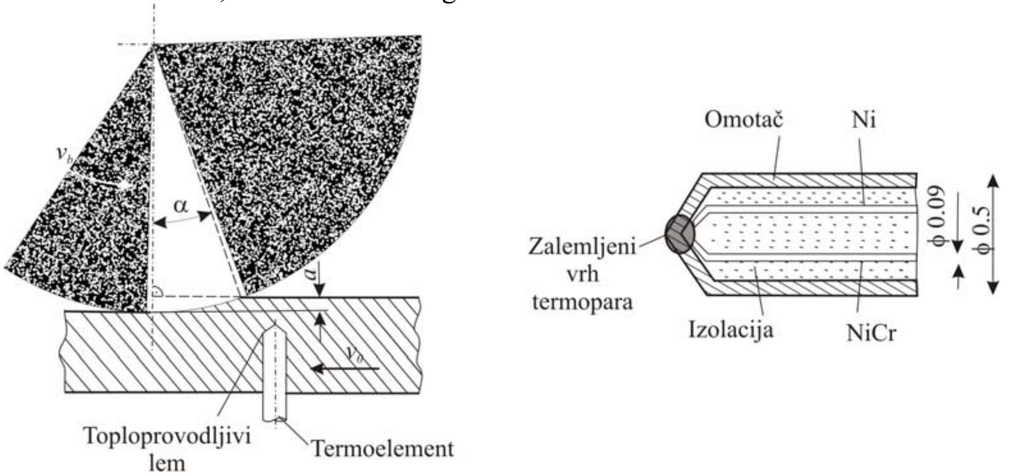
ABSTRACT
More and more strict demands for high quality of surface stratum and the economic work in the process of grinding work put the necessity for studyings of possibilities of addapted managing at grinding work. Studyings about new unconventional material – Ti aloys seem to be particulary interesting. The review of studyings about addapted managing at grinding work is given in this work, preliminarily results of temperature arrangment by depth of subject Ti UTV6.
In work is tried to develop such kind of model for which is given an appropriately portable function which is shown in analitic and diagram form.

1. INTRODUCTION
Temperature measuring in the area of cutting is mostly unacceptable because of concentration of heath energy in very small area, high specific pressure and extremely high temperatures that became in very short period of time, usual methods of temperature measuring that is used in technical and physical experiments.

- ✓ Contact methods:
  - ☞ Method based of materials change
  - ☞ Method based on thermo electrical effect
- ✓ Touch free method, based on wavelength of heath "**infrared thermo metrics**".



Picture 1. Temperature measuring in processing temperature *at straight sanding with the help of thermo elements built in material*

This is an example of measuring contact temperature at straight sanding with the help of thermo elements built in material. Used thermo element is with radius of 0.5 mm with wires made of NiCr-Ni (Chromel-Alumel) and it isolated with oxide dust. To reduce time of response, wires are welded together with coating. This built miniature thermo elements are protected from outside electrical and mechanical influences and high oscillations, and outside factors and are very easy to assemble.

2. CHARACTERISTICS OF Ti ALLOYS

Titan is the ninth most spread out element on earth and covers 0.6% earth. Between construction metals it is the fourth most spread, right behind aluminum, magnesium, iron, while is much more spread then chrome, nickel, copper, lead and other metals.
At temperature of 1155K titanium goes through one polymorphic change where it changes crystal bar, actually it comes to alpha beta transformation.
Titanium is silver grayish metal with physical characteristics that are lot different than physical characteristics of mostly used metals.
Titanium has high melting point, but because of it absorbs nitrogen and oxygen at temperatures higher then 946 K it is not useful at high temperatures exposed to oxygen.
Pure titanium is not adequate as construction material because in this condition is relatively soft and elastic. Titanium with commercial quality has certain inter crystal elements such as oxygen, nitrogen, carbon and is much stronger and it can be used as construction material.
Electrical and heath conduit are low and as such is not adequate for use where heat and electrical conduit is needed.

Table number 1. Basic mechanical characteristics of pure and commercial titanium

Characteristic	Pure titanium	Commercial titanium	
		Low hardness	Low hardness
Bulk modules (10 N/mm^2)	11.000	11.000	11.000
Glide modules (N/mm^2)	45000	45000	45000
Dragging hardness (10 N/mm^2)	20-30	45-55	60-70
Distension limit (10 N/mm^2)	12-18	30-40	50-60
Elongation (%)	40-60	20-30	20-25
Sections reduction (%)	70-90	40-70	40-50
Hardness (HV)	80-100	160-180	200-220
Impact toughness (10 N/cm^2)	4-12	4-12	4-12

Low coefficient of heath expansion makes it possible to be used in construction where there is periodical temperature change, with specifically weight up to 4.5 gr/cm^3 titanium is closer to light metals, while heath and electrical characteristic is closer to rust-proof iron. Titanium is non magnetic, what makes it easier to use in geophysics and electrical connections.
Titanium has high affinity to hydrogen, oxygen, nitrogen, and as such is useless at high temperatures. Under temperatures of 773k at under on unmixed titanium oxide film shows and reduces intensity of oxidation in time. Over temperature of 773k oxide film is destroyed and oxygen enters and causes for shorter life span of construction.
Impact toughness is the most effective test to find out percentage of predisposition to hard aberration.
Influence interstiction alloy elements are of big importance especially in construction of welded titanium elements. Influence of hydrogen is exposed in all phases of construction of one titanium machine, starting with cleaning all the way until finishing. Content of hydrogen in alloy commercial grade does not have any big influences on dragging hardness but its one of the causes of hard break due to hits. Content of hydrogen in titanium tin can be reduced in vacuum oven. In titanium alloy on

base of aluminum and solder higher content of hydrogen can be tolerated. Carbon, oxygen, and nitrogen show like left over impurity in all alloys titanium as well in pure commercial grade titanium.

3. SHORT VERSION OF MODEL

3.1. Definition of function in analytic form

According to own experiments (picture number 2), characteristics and profile of temperatures field for observed type of grinding it can be concluded that profile of temperature field along the *r* coordinate for processing resume can be approximate with definition:

$$T(r) = (\Delta T + T_0) \cdot e^{-(R-r)m} \tag{1}$$

Where is ΔT rising temperature area of T_0 temperature surrounding until final value for such processing conditions and *m* exponent is dependable from material kind of finishing.

Temperature difference ΔT is determined by elements of cutting, content of materials, way of finishing as well as intensity of cooling and characteristics of cooling and lubrication. It is at similar condition linearly dependable of radial components, of resistance F_r and at unchanged cutting of machine and speed of shaving of metal v_m. This connection is determined over intensity of heat well in area of cutting.

$$q = \frac{\xi \cdot v_t}{A} k \cdot F_r \tag{2}$$

Taking in consideration everything above, we can write that is:

$$\Delta T(\tau) = k_0 \cdot F_r(\tau) \tag{3}$$

Due to the connection Fr and the speed of metal shaving v_m [3]

$$k_{rez} = \frac{v_m}{F_r} \tag{4}$$

And depending on thermo physical characteristics and geometric of the processing subject.

If equation (16) include into equation balance of movement in area of cutting and movement expressed in shaving off metal speed v_m [3] that it gets shape

$$v_n + v_m + a_2 v_m + a_3 \frac{dv_m}{dt} + a_t \frac{dv_m}{dt}, \tag{5}$$

This equation for the small accession is written in operational form (complex form) and it has the form:

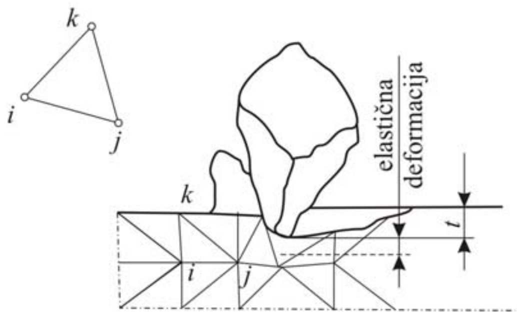
$$v_n(p) = v_m(p) + a_2 v_m(p) + a_3 p\, v_m(p) + a_t p\, v_m(p) \tag{6}$$

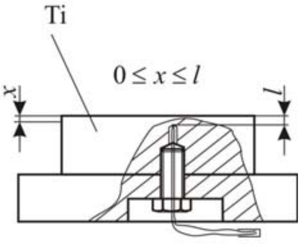
To which suits transfer function of the forms.

$$A(p) = \frac{v_m(p)}{v_n(p)} = \frac{1}{(1+a_2) + (a_3 + a_t)p} = \frac{k_c}{1+T_p}$$

Clip changeability of "thermal process" with more assumptions excepted shows in a way of exchanging function without momentum frame:

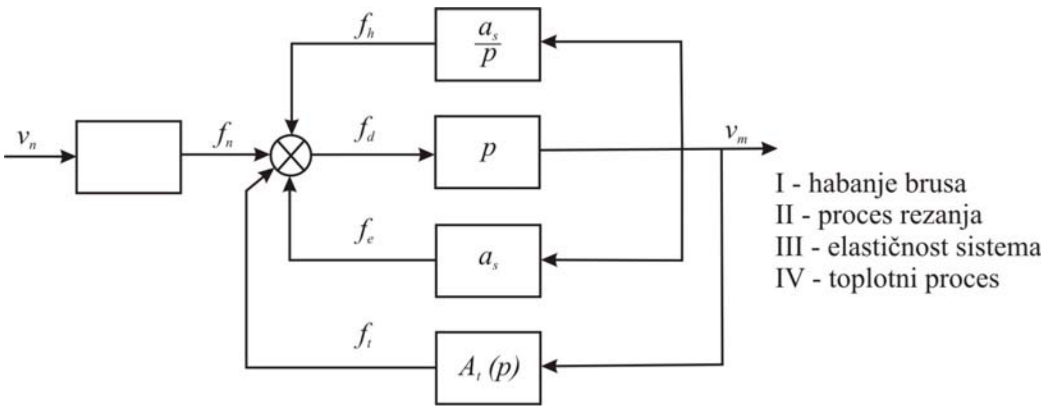
$$A_t(p) = \frac{f_t(p)}{v_m(p)} = a_t .$$





3.2. Definition of the function in diagram shape

In a case when function $T\ (r,\tau)$ is limiting duration of the transfer process proportionally to time of stabilization of elastic deformations in the system of the engine- tool-processing subject, represents clips “thermal process” in a form of transfer function, it is very complicate because of difficult arithmetic presentation of stability its thermal deformation and coefficient of clip “thermal process” transfer. In these cases approach is experimental valuation of mentioned elements.



Picture 3. Structural scheme of grinding process with temperature deformation of processing subject

6. CONCLUSION

For the identification of dynamic abrade machining system in conditions of disarrangement factors activity with accidentally determinate origin, by the time and place of origin, statistic concept of individual entrance and exit system identification is necessary prerequisite.

Research results show that current function values: grinding resistance and processing subject roughness have Gauss trend distribution.

7. REFERENCES

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