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RESEARCHES REGARDING OF USING ENGINEERING PLASTIC PRODUCT IN COOLING BED ROLLING MILL CONSTRUCTION

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ABSTRACT
In brake mechanism of cooling bed rolling mill construction, bush bearing is bronze made. For replaces of this material with engineering plastic product, it was calculated analytical and using simulation, forces in node of braking mechanism. Using these loads, it was make simulation regarding behaviour of static loads with finite element software. Finally, it was studied behaviour in service of this engineering plastic bush using of scale model mechanism.
Based of these researches, this bush bearing can be made from engineering plastic product, in same qualitative and technical condition, and this is a way to reduce maintenance and exploitation cost.
Keywords: brake mechanism, engineering plastic, attrition

1. INTRODUCTION

The cooling bed from small profiles rolling mils of is one of the most complicate constructive-functional cooling beds, first of all owing to a lot of mechanisms which compose that bed and to functions correlations necessity to each phase mechanism of technological process.

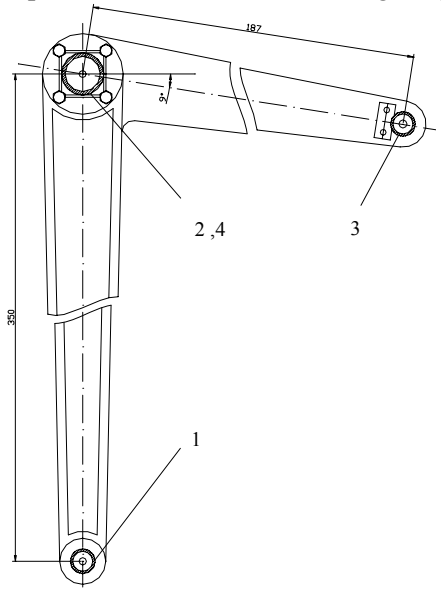

Figure 1. Sub ensemble of first wire brake mechanism, 1,2,3,4 – bronze bushes

Owing this cooling bed, small profiles rolled longs and cooling bed is long. So, the mechanisms of bed components are made by a base multiply, on a 120m length. The studied sub ensemble, presented in figure 1, take part from the first wire brake mechanism. All of bushes are made of bronze, CuSn6Zn4Pb4, but with different geometrical size.

2. THE KINEMATICS AND CINETOSTATIC ANALYSIS

The first wire brake mechanism is a plan mechanism, with one motor element. It is represented in repose position. For kinematics analysis, is necessary a structural decomposition of first wire brake mechanism, [3]. Also, the angle between extreme positions is 47° and couple trajectory adequate by one complete rotation of crank is presented in figure 2. For the studied case we consider that the motor element has a rule movement law with constant speed and zero acceleration; the angular speed is ω_1=6,28 rad/s.

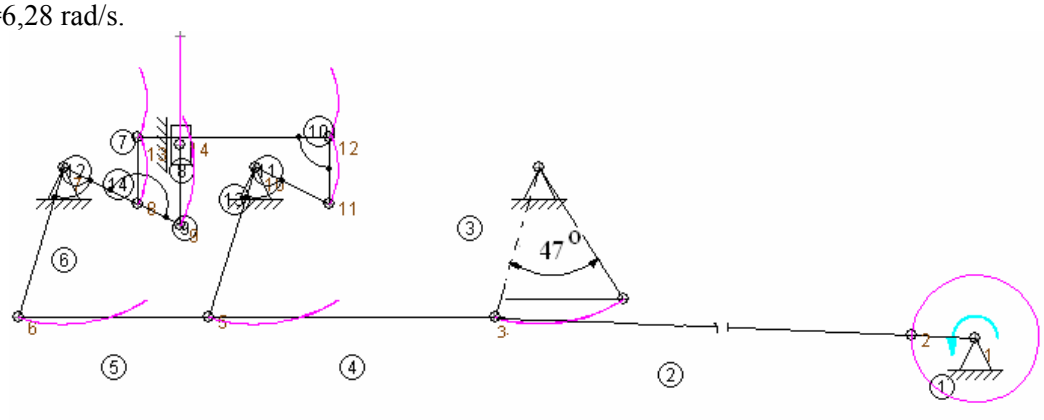

Figure 2. Cinematic scheme and couple trajectory adequate by one complete rotation of crank

For the kinetostatic analysis the previous made mechanism is attached at the constitutive elements load in the middle of element load, reported at the first couple of element. Will establish the numerical values for the motor moment and the useful and resisting force. The study is made in condition of gravity accelerations, [1].

After the kinetostatic analysis is presented force variation for one cinematic cycle, the variation presented in figure 3. We must say the nodes force was approximated by successive evaluations.

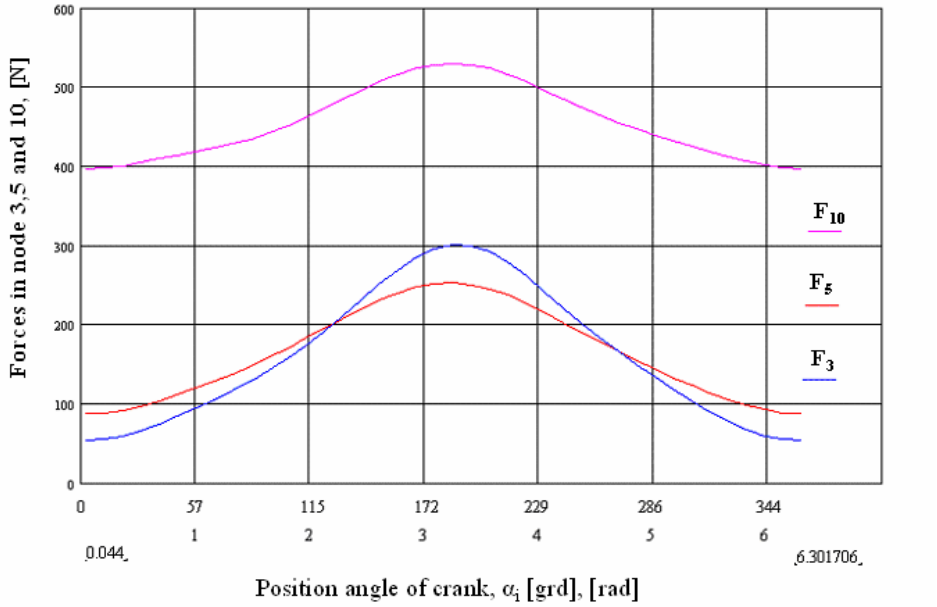

Figure 3. Forces in node 3,5 and 10, depending of position angle of crank.

3. THE ANALYSIS WITH FINITE ELEMENT

With the maxim absolute force will be analyse, using analysis software with a finite element the jack behave from studied articulation. The comportment of static involve requirement can be evidence if the material is used in respective condition of work. The study will be making for the material Ertalon66SA in one case of loading. This case is on the half of bushes interior surface with a distribute force which actuate on all bush interior surface, uniform, and the outside surface is considered fix.

The maximum force is used on calculus; coming of age with a safe factor is 318,414 N. In this loading variant, the maximum values of tension from material are under the accepted values, [2].

In figures 4 is presented the equivalent stress and the displaced shape from bush for this loading case.

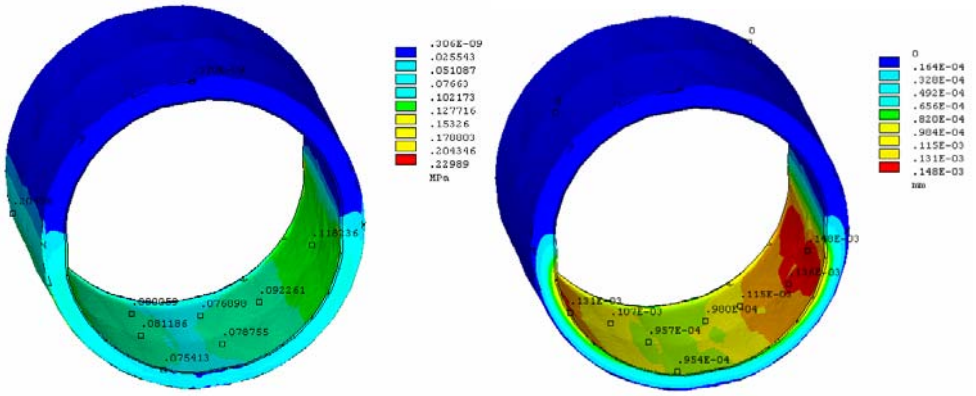

Figure 4. Maximum force and equivalent stress

The studied bush is considered representative for the all bush component of these mechanisms. If the bed cooling mechanisms are made from a big number of nodes, I consider that the material replace from bush with cheap one, will subtract the maintenance cost of cooling bed equipment. Finally we can affirm that in the end of this study the conclusion from static requirement and the low using temperature, the engineering plastic is used in the bearing construction.

4.EXPERIMENTAL RESERCH

For experimental research, is made test specimen (Ø4mm) and is cutting at 80 mm length. Bronze test specimen is made from used bushes (is cutting a part of bushes and is made sample of this part). Measurement it was made in 30 sec. period, for each loading period it was increase step by step. Recording of attrition was made with digital electronic balance Sartorius CP22025-OC, with automatic calibration and 0.01 gr. accuracy weighing.

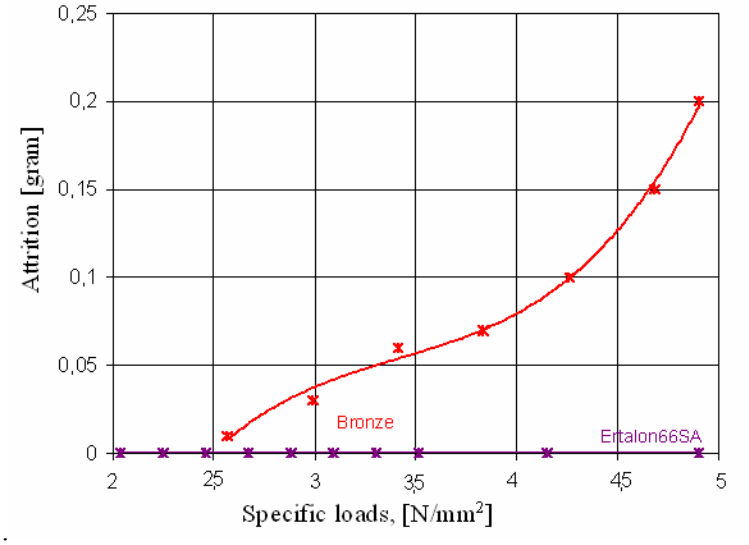

Figure 5. Attrition depending of specific loads

In figure 5 is presented comparative value of cumulative attrition depending on specific loads for bronze and Ertalon66SA .Based on this experiments, if make a comparison between testing specimen, in case on bronze comparative with Ertalon 66SA (per example), is observed an accentuated attrition (ridge formation) presented in figure 6.

Figure 6. Comparison between bronze and Ertalon66SA test specimen

5. CONCLUSION

The studied bush is considered representative for the all bush component of these mechanisms. If the bed cooling mechanisms are made from a big number of nodes, I consider that the material replace from bush with cheap one, will subtract the maintenance cost of cooling bed equipment.
Therefore Ertalon 66SA have a better behavior relative to bronze in this type of attrition test. This conclusion is based on calculus, simulation with finite element and experimental researches presented in this paper.

6. REFERENCES

[1] Ardelean M., Ardelean E. – Contributions to the kinematics analysis of cooling bed mechanism on profiled rolling mils, Acta Universitatis Cibiensis-techical series, Sibiu, 2006;
[2] Ardelean M., Ardelean E. - Contributions to the improvement of cooling beds mechanism of profiled rolling mils, Works of the 7th International Symposium "YOUNG PEOPLE AND MULTIDISCIPLINARY RESEARCH", Reşiţa, 22th-23th September 2005;
[3] Handra-Luca V. – Funcţiile de transmitere în studiul mecanismelor, Editura Academiei, Bucureşti, 1983.