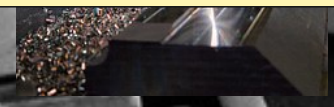
XIII INTERNATIONAL SCIENTIFIC CONGRESS
SUMMER SESSION

MACHINES. TECHNOLOGIES. MATERIALS 2016



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THE STRAIN OF CLAMPS ON CARRYING STRUCTURE

Prof. Dr. Hristovska E., Prof. Dr. Nusev Stojance, Assoc. Prof. Dr. Zlatko Sovreski,
Assis. Prof. Dr. Ivo Kuzmanov, Assis. Prof. Dr. Roberto Pasic
University St. Kliment Ohridski, Faculty of Technical Sciences, Bitola, Republic of Macedonia

elizabeta.hristovska@uklo.edu.mk

Abstract: *As a result of the conducted theoretical and experimental researches of the local state of strains at the most loaded intersection of the clamps on the working wheel's carrying structure in a concrete rotating excavator, an array of results has been attained. This paper represents systematically by means of diagrams the results of such researches under normal and specific working regimes of the excavator. The specific working regimes during the entire exploitation life of the excavator account for about 1 %, with the excavator working in specific cases while digging under unpredictable working conditions. The experimental magnitudes of the strains are obtained with conducted experimental measurement in compliance with the established methodology for this purpose. The theoretical magnitudes of the strains are derived using the established mathematical model of clamps and applied computer FEM analysis.*

Keywords: STRAIN, CLAMPS, ROTATING EXCAVATOR, DYNAMIC LOADS, NORMAL AND SPECIFIC WORKING REGIMES

1. Introduction

This paper analyzes the strain of the clamps (Figure 1) of the working wheel's carrying structure of the rotating excavator SRs-630 under exploitation conditions in the coalmine "Suvodol"-Bitola, under normal and specific working regimes.

The research of the strain is applied at the most loaded intersection of the clamps at few characteristic points. In order to obtain accurate magnitudes of the strain an experimental measurement was employed using the tensometric method postulates. The theoretical magnitudes of the stresses are derived with software package ALGOR-FEA analyzing an established mathematical model of clamps and using the principles of FEA method (Finite Elements Method), for accurate measured loads in the characteristic points (measuring positions) on the most loaded intersection of the clamps.

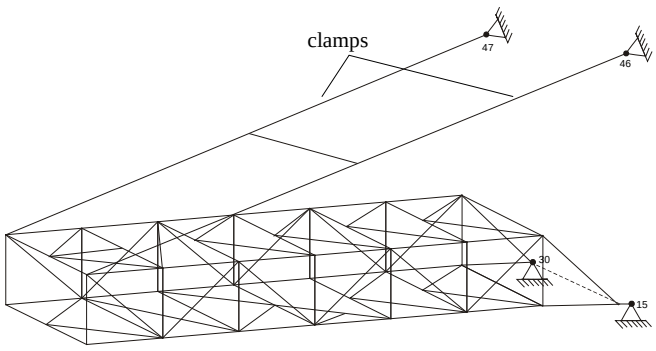

Fig. 1 *Clamp dogs and working wheel's carrying structure of the excavator*

2. Basic remarks on theoretical and experimental researches

The theoretical researches of the strain (stress) of the clamps under most unfavourable combination of the dynamic loads are conducted for normal and specific working regimes of the excavator. It means that for each normal and specific working regime, clamp are analyzed when simultaneously loaded with the measured maximal forces of tension at characteristic measuring positions of the clamps (shown on Figure 2), determined by experimental measurement.

The experimental researches of the stain of the clamps is carried out using an established methodology for measuring excavator constructions, which is outlined for this purpose which is not a simple one due to the complexity of the excavator's construction and its specifically exploitation conditions.

This research has shown that the maximal magnitudes of the loads do not act simultaneously at all measuring positions. Due to of the mentioned fact, it is logical that the theoretical determined strains of the clamps have higher values than the real ones.

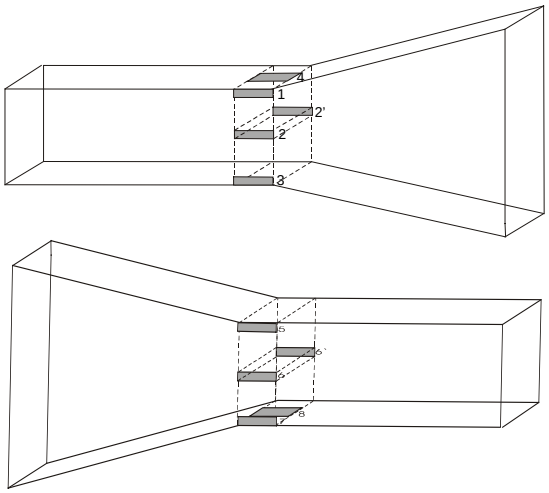

Fig. 2 *Distribution of measuring positions on the clamps*

The following normal working regimes are quoted hereunder:

- First regime - Uppermost position (of the working wheel carrying structure) and turning left,
- Second regime - Uppermost position and turning right,
- Third regime - Horizontal position and turning left,
- Fourth regime - Horizontal position and turning right,
- Fifth regime - Nethermost position and turning left,
- Sixth regime - Nethermost position and turning right.

As specific working regimes the following ones are quoted:

- First regime - maximal loading and turning left,
- Second regime - maximal loading and turning right.

3. Comparative results of theoretical and experimental researches

Under normal regimes

The comparative theoretical and experimental results under normal working regimes mentioned above comprising all possible working conditions in the rotating excavator exploitation life, are presented on figures numbered from 3 to 8, shown below.

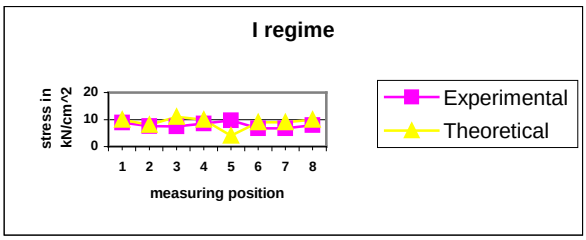

Fig. 3 *Strain of clamps at measuring positions under dynamic loads in First working regime of the excavator*

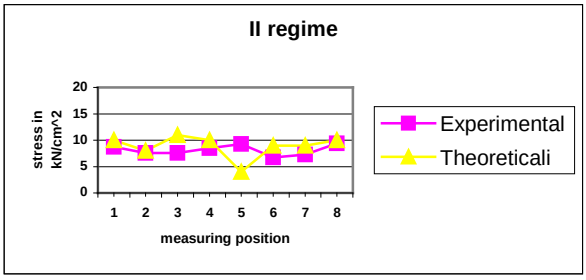

Fig. 4 *Strain of clamps at measuring positions under dynamic loads in Second working regime of the excavator*

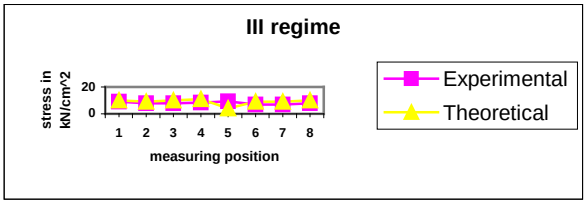

Fig. 5 *Strain of clamps at measuring positions under dynamic loads in Third working regime of the excavator*

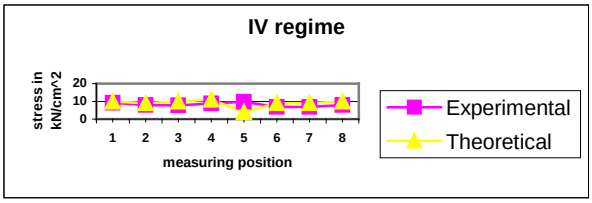

Fig. 6. *Strain of clamps at measuring positions under dynamic loads in Fourth working regime of the excavator*

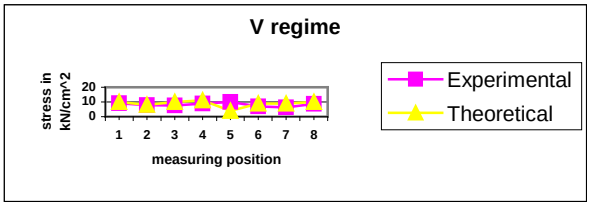

Fig. 7 *Strain of clamps at measuring positions under dynamic loads in Fifth working regime of the excavator*

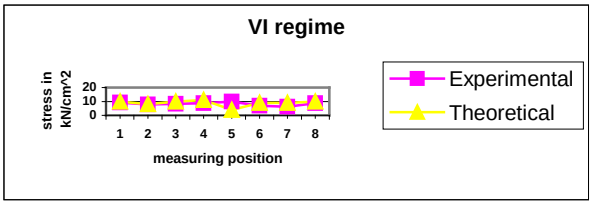

Fig. 8 *Strain of clamps at measuring positions under dynamic loads in Sixth working regime of the excavator*

Under specific regimes

The comparative theoretical and experimental results for mentioned specific working regimes in the previous section, which simulate maximum working loads in rotating excavator exploitation life, are presented on following figures numbered 9 and 10.

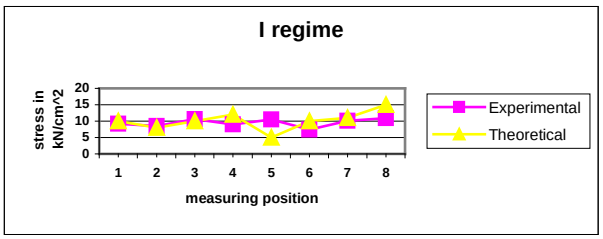

Fig. 9 *Strain of clamps at measuring positions under dynamic loads in First working regime of the excavator*

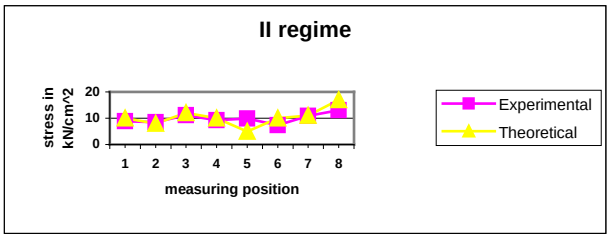

Fig. 10 *Strain of clamps at measuring positions under dynamic loads in Second working regime of the excavator*

4. Conclusion

Comparing the strain magnitudes from dynamic loads obtained by theoretical and experimental researches of the local stress state of the clams, points out different deflection, depending on the excavator's working regime. Deflections for regimes from I to VI are evaluated maximum up to 58 %. The deflections of the strain in the theoretical research model stem from the simultaneous loading with the measured maximal forces at each measuring positions (being not the case in experimental research).

This statement infers that the introduced models for theoretical and experimental researches of strain of the clamps, under normal and specific working regimes of the excavator, are not only original, bat give very exact results as well (according to experiences from the excavator researches). This allows their future use for similar types of rotating excavators which work under similar exploitation conditions. The specificities of excavator construction and working conditions should be considered in that case.

5. References

[1] Hristovska, E., Establishing a methodology for experimental measuring of loads and stress state determination on clamp dogs of carrying structures, Tribology in industry, Journal of the Serbian tribology society, Kragujevac, Serbia, Vol. 37, No. 4, 2015, pp. 464-472

[2] Hristovska, E., Characteristic of the working load on the rotating excavator, VIII International Conference "Machinery, technology, materials", Sofia, Bulgaria, 26-28 May, 2010.

[3] Hristovska, E., Bahtovska, E., Comparative diagrams for research on local state of stress of the clamp dogs of a rotating excavator from static loading, 2nd DAAAM International Conference of Advanced Technologies for Developing Countries-ATDC'03, Tuzla, Bosnia and Herzegovina, 25-28 June, 2003.

[4] E. Hristovska: Concept solution for measuring on working loadings of the clamp dogs of the carrying structure on the rotating excavator's working organ, International Conference 4E Ohrid, Macedonia, 3-4 October, 2002.