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ASPECTS CONCERNING THE STRESS AND DISPLACEMENTS FROM THE STRUCTURE OF THE METALLIC TOWERS OF THE EXTRACTING INSTALLATIONS WITH TWO WHEELS DURING AN EXTRACTING CYCLE

Itu Vilhelm, University of Petrosani, University Street, number 20, zip code 332006

Abstract: *In the paper there are presented aspects concerning the state of stress and displacements from the structure of the metallic tower of an extracting installation given the loads which are transmitted through the bearings of the deviating pulleys from the tower during an extracting cycle. The extracting installation is unbalanced with extracting vessels untipping elevators and the extracting machine with two wheels and operating asynchronously.*

Key words: *Strains, displacements, metallic tower, extracting installation.*

1. INTRODUCTION

For the study of the state of stress and displacements from the structure of the metallic towers due to the loads transmitted during an extracting cycle, functioning normally, the study focused on the tower of installation of extraction from the auxiliary well number 2 from the Lonea mine, and it's general and exploitations data is presented in the following.

2. THE PRESENTATION OF THE INSTALATION

The auxiliary well no 2 is destined for supplying the underground with materials and tools, for the transportation of personal and the eviction of sterile the transport is made to and from the 400 horizon.The extracting installation which serves the well is unbalanced(without an equilibrium cable) and has an extracting machine, which lays on the ground, type: 2T-

3,5 × 1,7. Another main component of the extracting installation is the metallic tower. The structure of the tower is made out of the deviating pulleys platform sustained by the guidance part and the two latticed structures from the sides and the tower's abutment.

3. LOADS TRANSMITTED TO THE TOWER

For the determination of stress and displacements during a transport cycle, from the structure of the metallic tower of the installation taken into study there have been taken into calculation the loads that are transmitted to the tower considering the cases when one of the two elevators loaded is climbing on one of the branches. For this purpose, it has been taken into analysis the case when the full elevator(at max load) is climbing on the left branch (case 1, left elevator going up, right elevator going down) and the case when the full elevator is climbing on the right wing (case 2, left elevator going down, right elevator going up).The calculation of the loads acting upon the tower through the deviating pulleys has been made taking into account considering the static forces ,the friction forces and the dynamic forces. In the calculation of the loads the d'Alembert principle was used ([2]) decomposing the efforts from the cable chords, in their touch points on the pulleys into components on three perpendicular directions which correspond to the axis system chosen in the discretisation of the structure of the tower of the installation (fig.1). Therefore the Z axel was chosen to correspond horizontally onto the pulleys axel, and the X and Y axis perpendicular onto Z, situated respectively horizontal and vertical.

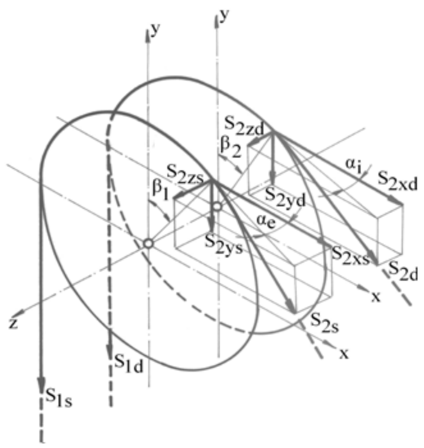


Fig.1. The chart of the efforts from the extracting cables on the margin of the pulleys

Following the exposed facts and taking into consideration that the z axis effort parallel component creates momentum towards the bearings of the pulleys, (considered supports(ties) of type bearing axel with shoulders), there have been determined the forces that act upon the tower through the bearings, forces decomposed on the three directions X, Y and Z. In fig 2 and fig. 3 there is presented the variation of the components of the forces from the bearings depending on thenumber of spirals of the extracting The components of the efforts from the cable chords varied both because of the incline angles of the chords but also because of the deviation angles of them cable from the surface of the rolling organ. The number of spires rolled onto each one of the two wheels is 34 and the active ones(which roll and unroll during an extracting cycle) are 29. The length of a spiral is 10,486 m.

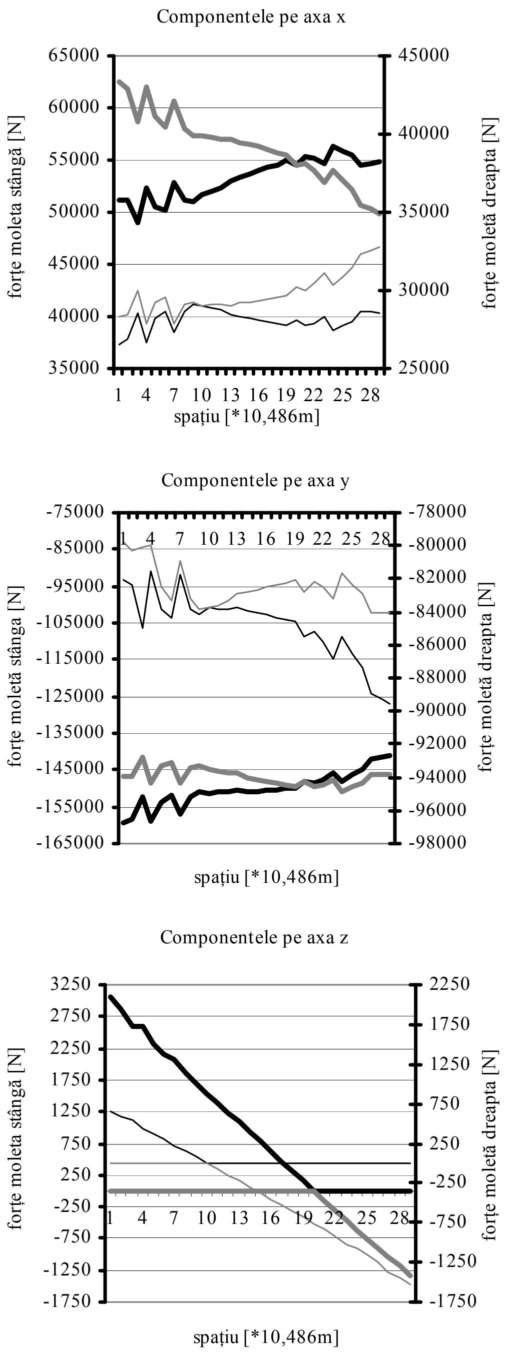


Fig. 2. The components of the forces in the bearings of the pulleys from the left and right on the three axis (X,Y,Z) for case 1.

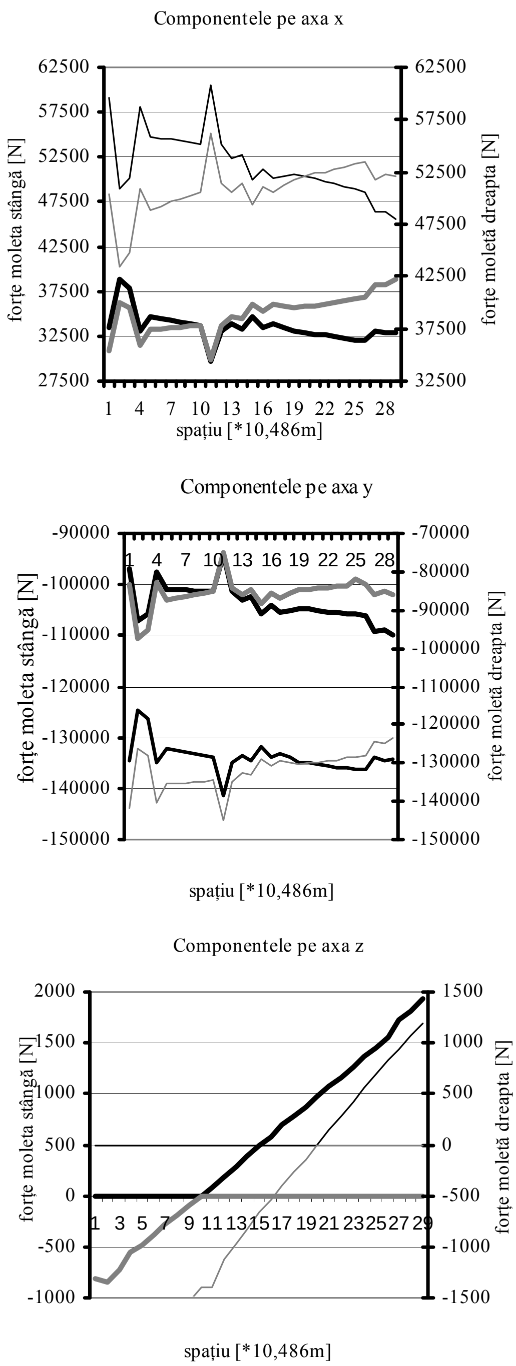


Fig. 3. The components of the forces in the bearings of the pulleys from the left and right on the three axis (X,Y,Z) for case 2.

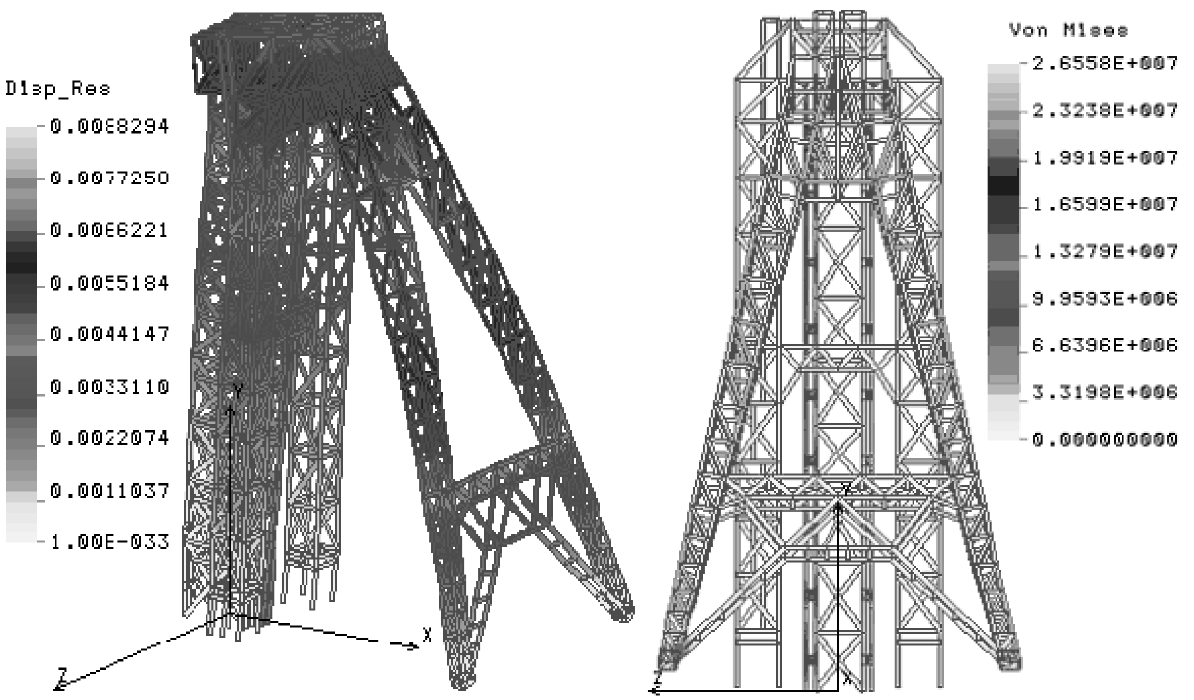
4. STRAINS AND DISPLACEMENTS

Due to the complexity of the resistance structure of the metallic tower the most adequate method for study the state of stress and displacements is that of the finite element.

In order to analyze the state of stress and displacement with the finite element method the structure of the tower has been discretised into bar type elements (BEAM 3D) and type shell (SHELL 3), adequate to each component from the structure of the tower. There have been defined the geometrical and geomecanical structures of all the elements which compose every element which enter in the discretisation of the tower structure and then they have been introduced to the calculation software.In the cases taken into consideration it has been considered the mass of the structure of the entire tower calculated using the software

For case 1 and respectively case 2 taken into study, in the determination of stress and displacements there have been considered the subcases from the beginning and ending (the acceleration and deceleration period) of an extracting cycle.

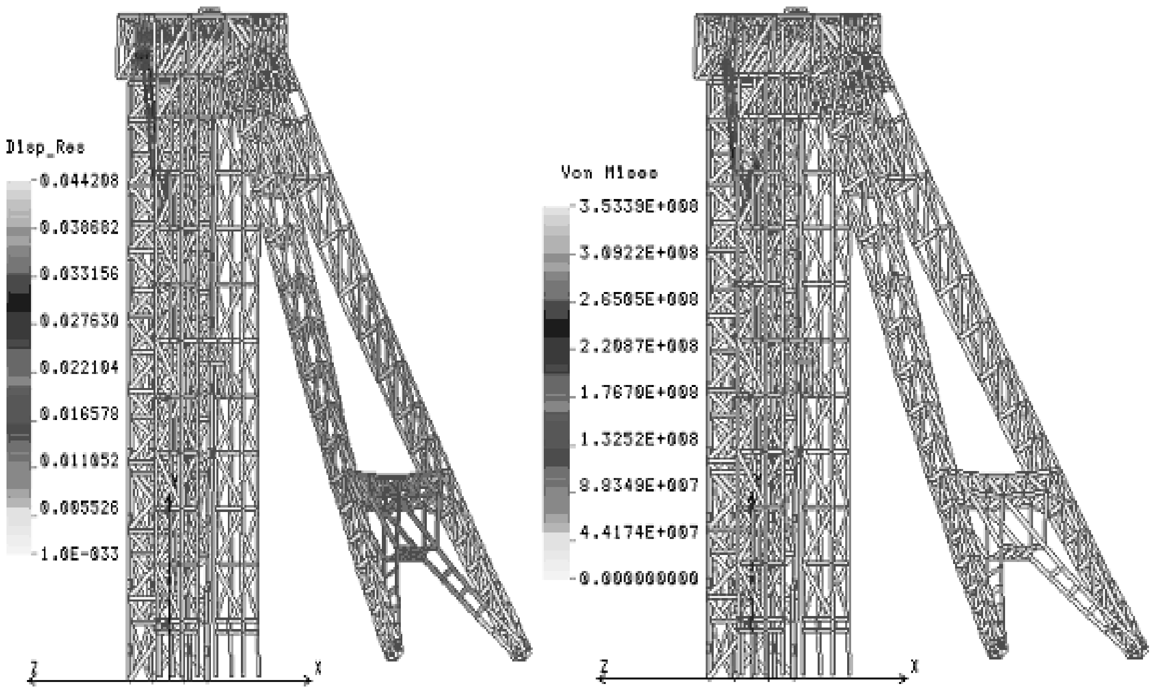
In fig 4 a) and b) there are presented the displacements and stress for subcase 1a, and in fig 5 a) and b) for subcase 1b.In fig 6 a) and b) there are presented the displacements and stress for subcase 2a, and in fig. 7 a) and b) for subcase 2b.



a) b)

Fig. 4. Normal functioning, left climbing, right descending (case 1a, x346)

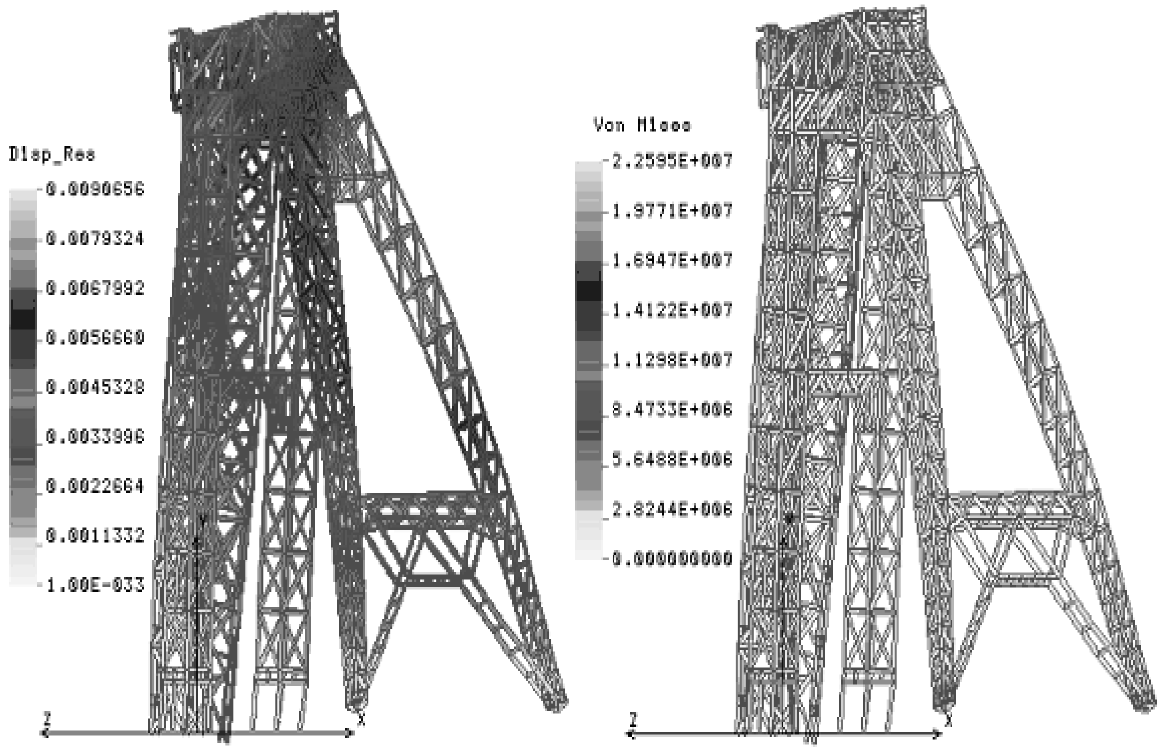
a) displacements; b) mechanical stress.



a) b)

Fig. 5. Normal functioning, left climbing, right descending (case 1b, x 68)

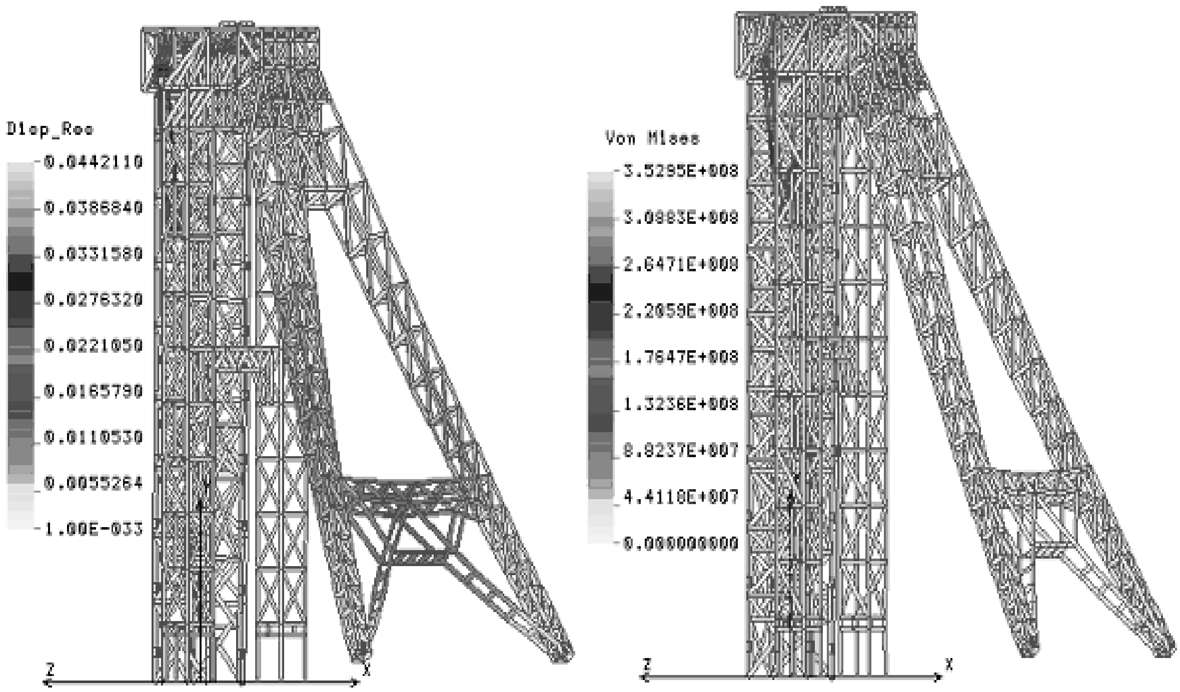
a) displacements; b) mechanical stress.



a) b)

Fig. 6. Normal functioning, left descending, right climbing (case 2a, x 339)

a) displacements; b) mechanical stress.



a) b)

Fig. 7. Normal functioning, left descending, right climbing (case 2b, x 68)
a) displacements; b) mechanical stress.

5. CONCLUSIONS

The stress and displacements in the considered cases are within bearable limits.

Following the obtained results it has been noticed that the most stressed, and having the most displacements compared to the rest of the elements are the feet of the abutment, the platform of the pulleys, and the piles situated sideways to the leading part.

There have been determined and localized the maximum values of the stress and displacements from the elements composing the towers structure in order to establish the measuring points, for the verification of the calculations made through the numerical methods with the help of experimental measuring.

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