13th International Research/Expert Conference
"Trends in the Development of Machinery and Associated Technology"
TMT 2009, Hammamet, Tunisia, 16-21 October 2009

LOADING EXTERNAL DIGGING RESISTANCE CAUSED BY THE EXCAVATIONS WITH ROTORS

Beqir Hamidi, Musli Bajraktari, Ilir Doçi
University of Pristina, Faculty of Mechanical Engineering

ABSTRACT
In this paper is the appointment of external loads caused by the resistance scrabble, which will enable the establishment of mathematical model of excavations with rotors, which are incorporated constructive and relevant parameters. Appointment of external loads enables solid solutions to design, reliability to excavations with rotors. Technique using computer programs and package will classical methods of reviewing and analyzing the loads of excavations with rotors, which appear in real conditions.
Keywords: excavations with rotors, dynamic model, potential energy, generalization coordinate.

1. INTRODUCTION
Exploitation of the mineral surface, first of all the coal, requires vehicles with large capacity, with relatively small expenditure of energy specific. Intensive development in recent years, excavation with the rotor have achieved priority in comparison.Scheme is presented excavation with rotor characteristics: Dr=12.5 m, Pr=1000 kW, Qt=6000 m3 / h, t = 3800, firm KRUPP, produced in 1989 [3].

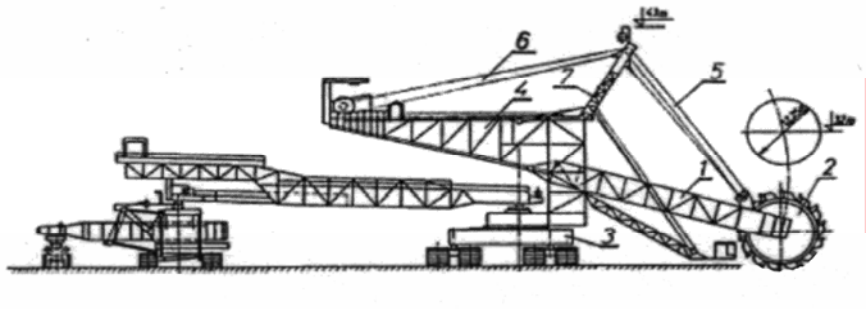

Figure 1. Excavation with rotor.

2. APPOINTMENT OF GENERAL RESISTANCE DIGGING
Fundamental characteristics of the process digging to excavation with rotor are essentially the work of her unceasing. During this number of pail involvement in the base that is variable. In each bucket, which is in contact with the base that affects resistance digging, [1,2].Given the real resistance in digging edged the secant pail, can that components of the resistance of normal and tangential resistance digging affects the rotation of rotor, while the side components are the normal. Given the real resistance in digging edged the secant pail, can that components of the resistance of normal and tangential resistance digging affects the rotation of rotor, while the side components are the normal. Depending on the direction of movement of rotor, the direction of the wing to rotor, edged one side,

will be the first, while the other end. Based on this, the flow resistance of the overall digging affecting bucket-and assigned to the expression:

$$R_{ki} = \sqrt{R_{Ti}^2 + R_{Ni}^2 + R_{Bi}^2} \quad (1)$$

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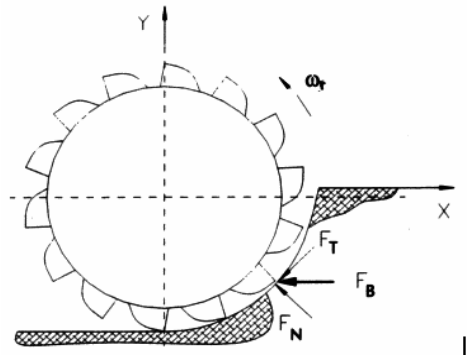

Figure 2. Components of resistance digging.

Intensity of the vertical and horizontal components of resistance digging affecting the bucket of the in x and y is:

$$F_{Vi} = F_{Ti}^x + F_{Ni}^x = k_F b_o s_o \sin\psi_i (\sin\psi_i + k_N \cos\psi_i), \quad (2)$$

$$F_{Hi} = F_{Ti}^y + F_{Ni}^y = k_F b_o s_o \sin\psi_i (\cos\psi_i - k_N \sin\psi_i). \quad (3)$$

Allocated to general cargo, due to resistance digging must necessarily be conducted to collect all the influential factors that announced to all pail performed digging area when given. Currently about, causes only a tangential component of the resistance digging and is defined by the moment:

$$M_i = rR_{Ti} = rk_F b_o s_o \sin\psi_i \quad (4)$$

3. LOADING EXTERAL EXAVATION WITH ROTOR

Allocated to general cargo, due to resistance digging must necessarily be conducted to collect all the influential factors that announced to all pails performed digging area at the time of grant, (figure 2) if general digging corner of the base is the number average pail on the basis, while the angular step is that inclusion is: With the collection of vertical force components of each bucket, is obtained.

$$F_{v\max} = \sum_{i=1}^{n_{K\max}} k_F b_o s_o \left(\sin^2\psi_i + k_N \sin\psi_i \cos\psi_i\right). \quad (5)$$

After the release of pail from digging, comes to the collapse of the intensity of vertical forces on the αsize of components, vertical from pail that emits digging. For this case is $\psi_i = \alpha$., if this replacement is done in expression (5), is obtained:

$$\Delta F_v = F_{Vi}\big|_{\psi i=\alpha} = k_F b_o s_o \left(sin^2\ \alpha + \frac{1}{2} k_N\ sin 2\alpha \right). \tag{6}$$

Minimum vertical forces are:

$$F_{V\,min} = F_{V\,max} - \Delta F_V . \tag{7}$$

The average value of vertical forces assigned on the basis of speech:

$$F_{Vm} = \frac{F_{Vmx} + F_{V\,min}}{2} . \tag{8}$$

However, changing the minimum values of vertical forces to the maximum, get really, is not linear. Given that the influence of normal forces in vertical forces is such that in x is greater when the intensity of the normal force is smaller, and is zero when has maximum intensity. Its influence in the further analysis can be overlooked. The average value of the integral components derived from resistance digging in the bucket of the given expression is:

$$\overline{F}_{Vi} = \frac{1}{2} \int_0^{\alpha} k_F b_o s_o\ sin^2\ \psi d\psi = \frac{k_F b_0 s_0}{2} \left(1 - \frac{1}{2\alpha} sin\, 2\alpha \right). \tag{9}$$

If distributed in the entire perimeter of rotor and taken into account in the rotor have pail, then obtained the average value of integral vertical forces.

$$\overline{F}_V = \frac{F_{Vi}}{2\pi}, \quad n_k = \frac{F_{Vi}}{2\pi} \frac{2\pi}{\theta} = \frac{k_F b_o s_o}{2} \left(1 - \frac{1}{2\alpha} sin\, 2\alpha \right). \tag{10}$$

Horizontal and vertical forces and moment created in the backbone of rotor, caused by resistance digging affecting pail, which are the involved in material digging:

$$F_V = \sum_{i=1}^{n_{kt}} F_{Vi} = k_F\ b_o\ s_o \sum_{i=1}^{n_{kt}} sin\psi_i (sin\psi_i + k_N\, cos\psi_i), \tag{11}$$

$$F_H = \sum_{i=1}^{n_{kt}} F_{Hi} = k_F\ b_o\ s_o \sum_{i=1}^{n_{kt}} sin\psi_i (cos\psi_i - k_N\, sin\psi_i) \tag{12}$$

$$M = \sum_{i=1}^{n_{kt}} T_i = R\, k_F\ b_o\ s_o \sum_{i=1}^{n_{kt}} \sin\psi_i . \tag{13}$$

4. APPOINTMENT OF DIAGRAMS OF THE EXTERNAL LOADS

Given the functional form which shows the change of FV, FH and M over time concludes that these meet the requirements of literature [3], respectively, it is possible to place the order trigonometric rave-as. Diagrams changing FV, FH, and M, over time, are shown in figures 3, 4 and 5.

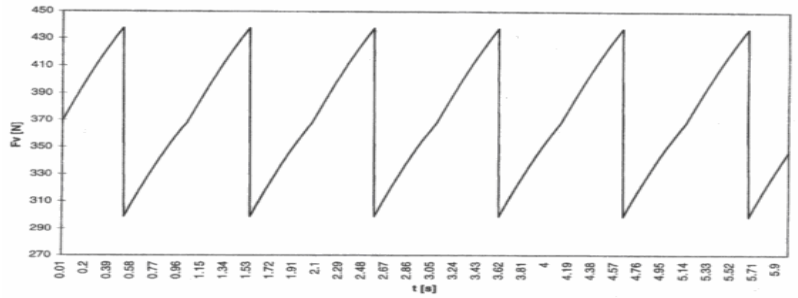

Figure 3. Vertical components of resistance digging.

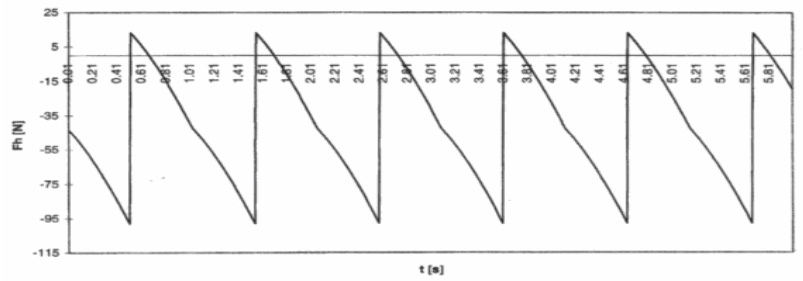

Figure 4. Horizontal Components of resistance digging.

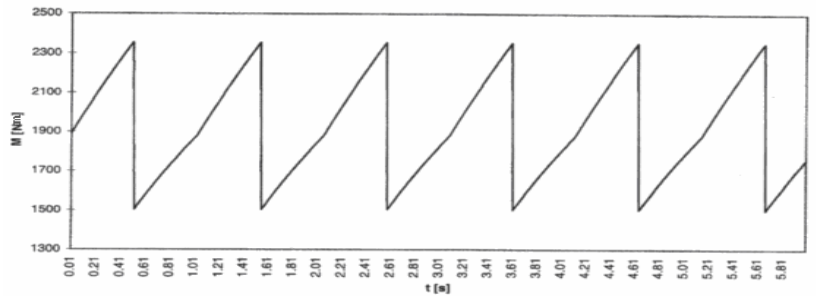

Figure 5. Moment in the backbone of rotor.

5. CONCLUSIONS

On the basis of the submitted in paper, these findings can be drawn:

- for the analysis of external loads excavation with rotor, should be recognized digging theory and factors that affect long digging;
- analysis of kinematics excavation with rotor, should be considering moving the excavation with rotor as composite;
- vertical geometry of digging, analyzed according to the position of wing rotor, displacement and position pail to rotor;
- external loads obtained with the method of the elements of recent, fundamental values taken for the appointment of potential and kinetic energy of excavation with rotor.

6. REFERENCES

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