The question of hanger rotation unit of roller-bit drilling rig sbsh-250 elastic parameters determination

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Abstract
The problem of rise of the high dynamic loads of the mechanical and electromechanical equipment of roller-bit drilling rigs, which are used when ore deposits open-cast mining, is considered. The reason of their rise is described. The objectives are stated and need of carrying out of rig drilling flights rotation node hanger damping parameters experimental researches is proved. Techniques of theoretical and experimental determination of losses static coefficients ψ, defining the rope damping capacity, and testing bench for hanger ropes are described. The testing results are given in the form of rope tension diagrams (when its loading and unloading) and losses coefficients determination.
Key words: BOREHOLE ROLLER-BIT DRILLING RIG SBSH-250, DRILLING RIG ROTATION HEAD HANGER DAMPING PARAMETERS

The roller-bit drilling rigs of SBSh-250 type have widespread application in the conditions of open-cast mining of ore deposits. The process of borehole boring by this equipment is characterized by the intensive vibrations of rigs drilling flights, which are transferred to their base nodes reducing reliability and durability of the mechanical and electromechanical equipment [1]. The resonant vibratory-percussion scraping mode (RVPSM) of drilling device on the borehole wall is the reason of this; this mode occurs when drilling [2].

The experimental researches of stiffness and elasticity parameters of drilling rig rotation node hanger were carried out at Kryvyi Rih National University for the purpose of the drilling rig SBSh-250 vibration parameters determination. Since the rig is equipped with the rotation head installed on the hanger of rope-polyspast type, the rope of 28-G-V-N-R-1770 type was tested by GOST 2688-80.

The necessity of the rope experimental researches was caused by lack of the common unique dependence for ropes elasticity modules calculation [3]. Besides, the task of drilling rig hanger absorption coefficients determination was set. The absorption coefficient ψ_i is characterized by the ratio of dissipated energy ΔW_i in the rope to the energy of its deformation W_i, that is $\psi_i = \Delta W_i / W_i$.

Determination of absorption coefficient was carried out by method of hysteresis loop creation according to the Table data of experiments results by means of the Mathcad program and theoretical calculations (Fig. 1).

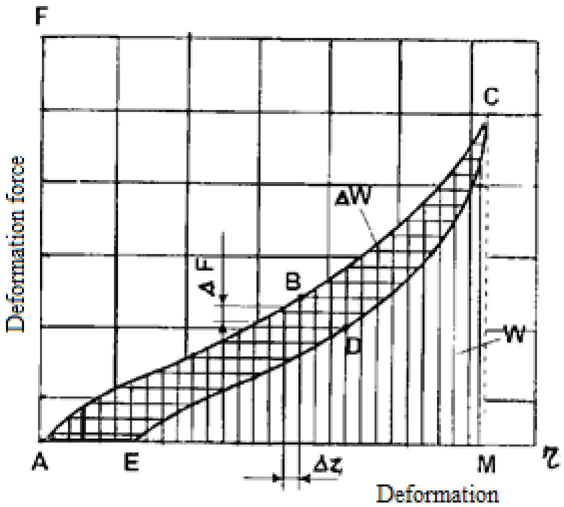

Figure 1. Hysteresis loop for elastically deforming element absorption coefficient determination: ΔW – area ABCDE; W – area ABCMA

As the experimental testing bench, the horizontal tensile machine of the Swiss firm "ALFRED AMSLER and Ko" with breaking tension of 200 t was used (Fig. 2). Before testing, the ropes samples were kept indoors at a temperature t = 22±2 ºC. Tests were carried out under the same conditions. For tests, two variants of the rope were selected: a) new and b) the one, which was run-in within not less than 2 weeks of operation on the roller-bit drilling rig SBSh-250.

In the course of experimental researches, the rope under test 8 was fixed in back poppet 2 and headstock 3 of tensile machine. The tensile force provided with a hydraulic cylinder 4 was applied to the rope. The rope L deformation size was determined with beam compass by measurement of distance between the measuring plank 6 fixed on bed 1, and hanger 7 of the headstock 3. The loading rate was indicated on a scale of the machine 5. At first, the rope was stretched with the step increase of loading up to the size of 20 t; then it was unloaded with reduction of loading practically to zero. The graphics for absorption coefficients determination using a method of the regression analysis are given in Fig. 3 according to testing results. The losses coefficient of a new rope is 1.5 times higher than of run-in one; at that, the rope was extended by 25-27 mm with each subsequent deformation. The length of run-in rope did not change, and the losses coefficient ψ remained almost identical. The distinction of results was not more than ±2%; that is in limits of an admissible error of experiments.

Figure 2. Fragment of the rope 28-G-V-N-R-1770 parameters researches (GOST 2688-80) of the drilling rig feed SBSh-250 of the tensile machine "ALFRED AMSLER and Ko": 1 – bed; 2 – back motionless poppet; 3 – movable headstock; 4 – the tension hydraulic cylinder; 5 – a scale for loading control; 6 – motionless measuring plank for the rope stretching control relating to the hanger 7 connected to hydraulic cylinder 4 rod; 8 – the rope under test; 9 – crane of pressure regulation in a hydraulic cylinder; L – distance between a measuring plank 6 and hanger 7, which was measured by means of beam compass.

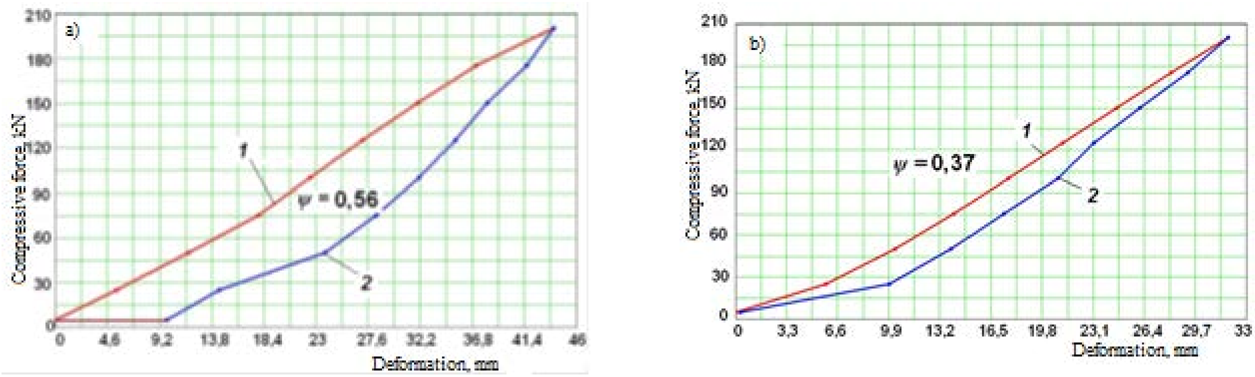

Figure 3. The rope 28-G-V-N-R-1770(GOST 2688-80) absorption coefficients: a) new rope; b) the rope, which was run-in within not less than 2 weeks; 1 - rope loading; 2 – rope unloading.

Conclusions: a) the losses coefficient of steel ropes, which are applied on the feeder of drilling flight of roller-bit drilling rig SBSh-250, is high (ψ = 0.37 and above); that is favourable for drilling flight feed vibration energy dissipation.

b) The preliminary ropes tension of polyspast system should be checked while in operation of a new rope at the beginning of each shift (during 15-20 shifts); the tension rate should not be less than 10% of working effort of drilling flight feed. It will exclude the top ropes deflection in the course of drilling and will provide the maximum damping of rotation head vibration.

References

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