



DAS 2016

Comparison of selected methods for the determination of the center of gravity in surface mining machines

Pawel Maslak*, Grzegorz Przybylek, Tadeusz Smolnicki

Wroclaw University of Technology, Faculty of Mechanical Engineering, ul. Lukasiewicza 7/9, 50-371 Wroclaw, Poland

Abstract

In the article it is presented the comparison of two methods of experimental determination of the center of gravity of machines used in opencast mining: measurement using strain gauge dynamometer and accurate precise manometers. Measurement methodologies were described. Parallel measurements were performed on spreader on the rail chassis. With both methods similar values were achieved.

© 2017 Elsevier Ltd. All rights reserved.

Selection and/or Peer-review under responsibility of 33rd Danubia Adria Symposium on Advances in Experimental Mechanics.

Keywords: Open cast mining machines; manometers; strain gauges; center of gravity.

1. Introduction

Balancing heavy machines opencast mining is necessary to ensure their stability [1, 2] and should be performed after every repair associated with the removal and installation of major components, the modernization of the machine, or if it is noticed alarming symptoms. Such a symptom can for example be increase of wear of slew deck bearings [3]. The force of gravity of the body and the excavated material on the machine with forces associated with the excavation in the case of excavator or the force of spread in case of spreaders, loads caused by the movements of the working equipment, wind, etc. causes the eccentric load bearing. Moving the resultant loading force to the

* Corresponding author: Pawel Maslak, tel.: +48 71-320-23-88.

E-mail address: pawel.maslak@pwr.edu.pl

bearing often leads to a substantial change in load distribution in the bearing (Fig. 1). Thus the observed accelerated wear of the bearings first step should be to verify the position of the center of gravity of the body.

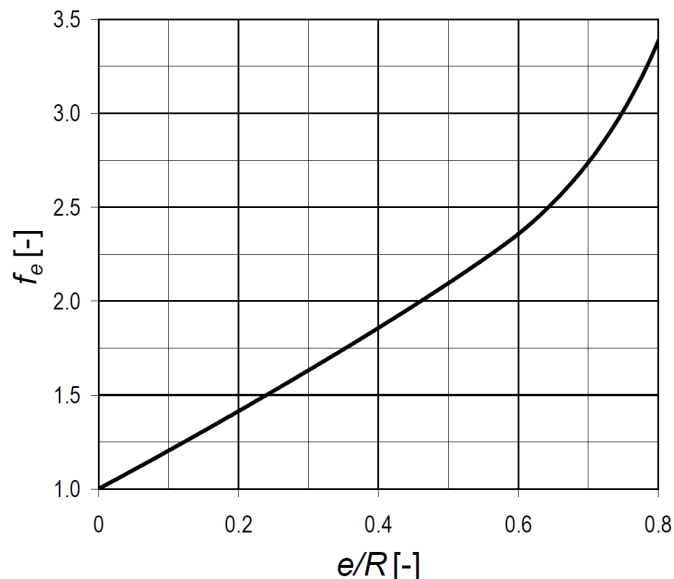


Fig. 1. The relative weight of the rolling element f_e as a function of eccentricity e/R of the resultant force in the bearing [3].

For machines where the body is located on the ball bearing, the weighted is body that is above the bearing, in the case of torque bearing (coronary) the whole machine is weighted. Weighing is based mostly on lifting the object on the hydraulic cylinders and then measure the loading force on cylinder. There are two ways of measuring: direct involving the measurement of pressure in cylinder, and indirect, in which between the cylinder and the slew deck is placed on a dynamometer equipped with strain gauge. Both methods have their supporters demonstrating the superiority of the methods used by him. To verify the accuracy of both methods the measurements were carried out at the same time.

Machines running on the chassis rail can also be weighed by measuring the load on rails by individual wheels of passing machine.

2. Methodology

The procedure of weighing machines requires the fulfillment of a series of conditions related to the security and accuracy of the results [4, 5, 6]. One of them is to reduce the wind speed when measuring the value of $5m/s$, the location of the machine on a flat surface, which is always possible only with certain accuracy, and a prohibition from entering those not directly participating in the measurement on the machine. The factors above, despite the limitations inflicted, are significant in determining the center of gravity and should be included in the correction as a result. Equal mistake but they are a burden on both the weighing method.

Weighing by measuring the pressure is very simple. The only equipment needed is accurate precise manometers. Currently used manometers with range 100 MPa, class 0,2 and accuracy 0,2 MPa. It is possible to connect the manometers with computer and simultaneous pressure reading. If you use more than one cylinder you can use two or four manometers (Fig. 2). The disadvantage of this method of measurement is interference in the form of friction in the hydraulic cylinders. Therefore, it is necessary to use efficient cylinders and make the same number of measurements during the lifting construction and during lowering. The advantage of this measurement method is its simplicity and the lack of temperature sensitivity.

Download English Version:

<https://daneshyari.com/en/article/5462262>

Download Persian Version:

<https://daneshyari.com/article/5462262>

[Daneshyari.com](https://daneshyari.com)