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Mathematical Modeling of Dynamic Loading of Cassette Bearings for Freight Cars

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Abstract

The article deals with the solution of the contact problem of load car axle-box cassette bearings. A model of finite elements of axle-box tensely deformed state is presented. The problem has been solved by the combination of the finite elements method and the generalized power method. Due to the results, we can define mechanical properties.

KEY WORDS: *caseette bearing, loading, finite-element models, ANSYS program*

1. Introduction

During structural designing of new rolling stock constructions, especially with the increased lift capacity, one should pay particular attention to the running gear construction [1].

As is known, the loading value of bearing rollers greatly affects their service life [2]. Reliable operation of cassette bearings is provided by proper distribution of load between the rollers. That is, if the central roller bears the load exceeding the standard value, such bearing will exhaust its operation time earlier and this, in turn, will lead to its premature failure and additional expenditure. That is why the theoretical study of contact loading distribution between the bearing rollers when designing the axle boxes is very important [6, 7].

2. Fluidic Muscle Parameters Research

In the freight cars with bogie the loading is transferred from the side walls to the axle neck of the wheelset through polyurethane cushion, adapter and cassette bearing. Contact surface of polyurethane cushion and side wall has a flat shape and covers the entire cushion. In this load transfer scheme, a possibility of overloading of the central roller for cassette bearing exists. One should find out while using the calculations what type of the contact loading distribution occurs between the rollers of the upper working area of cassette bearing in the bogie. Axle box unit of bogie model 18-7033, modeled by ANSYS program, is shown in Fig. 1.

Fig. 1 Axle box unit of bogie model 18-7033

To conduct these studies one of the modern software packages was used. The calculation algorithm involves the use of both the finite-element method (FEM) and generalized method of forces (GMF). Using the software package ANSYS, three flat finite-element models were built: with the polyurethane cushion, adapter and outer ring of cassette bearing (Fig. 2), with the inner ring of the cassette bearing and the wheelset axis (Fig. 3), with roller (Fig. 4) [1].

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