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Improvement of suspension system of Fbd wagons for coal transportation

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ABSTRACT

This paper presents the failure analysis and improvement of suspension system of Fbd wagons for coal transportation. Respecting the existing design of the wagon, the special solution of the rubber elastic element which was subsequently installed in suspension system is designed. The element is very easy to install in existing wagons, between the laminated spring buckle and underframe. The methodology of identifying the causes of unwanted fractures is focused on theoretical and experimental analysis of behavior of suspension system with and without rubber elastic elements. Subsequent installation of rubber elastic elements at about 400 wagons in thermal power plant "Nikola Tesla", Obrenovac, Serbia, has prevented the very frequent fractures of laminated springs and cracks on the underframes. This has enormously reduced costs of maintenance of wagons and increased the efficiency of railway transportation of coal from mining basin to the thermal power plant.

1. Introduction

The basic requirement of the railway is to be reliable, efficient, and cost-effective compared to the other modes of transport. The main prerequisites for meeting these requirements are continuous improvements of design and quality maintenance of railway vehicles and railway infrastructure. The failures on railway do not happen often, but when it happens, the consequence is usually derailment accompanied with enormous material damage and loss of human life. In addition, there is huge material loss caused by the interruption of the traffic and reparation of the infrastructure.

One of the most important parameters which determine the reliability and running safety of railway vehicles is functionality of the suspension system. In addition, the functionality of the suspension system affects the quality of ride comfort of passengers or cargo. Inadequate functioning of suspension system causes very serious consequences and in many cases may cause derailment. For this reason, the fault of suspension system is very important topic that is the subject of many scientific papers. The design and reliability of suspension systems in rail vehicle has previously been the subject of many papers, including those concerning the detection of faults [1–5] and analysis of failures [6,7]. The aim of all these researches was to indicate the potential problems and to give the motivation for improvements in existing or newly-designed solutions of suspension systems.

Failures of elements of the suspension system are particularly frequent when the wagons are used in extreme operating conditions. One such system is a system of railway transportation of coal from mining basin "Kolubara" to the thermal power plant "Nikola Tesla" from Obrenovac, Serbia [8]. The Railway line of this system has the characteristics of the railway line of first order, and consists of about 100 km of track. It is among the busiest industry railway lines in Europe with a maximum daily transportation of over 100 thousand tons of coal, while it is transported annually about 25 million tons of cargo. The transport of coal for many years is performed with about 400 Fbd wagons, made in Wagon factory Kraljevo (Serbia), specially

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