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MATHEMATICAL MODELING OF LONGITUDINAL LOADS FROM A RAIL TRAIN WITH A NEW CONCEPT COUPLER MECHANISM

Fomin[1] O., Lovska[2] A.
[1]*State University of Infrastructure and Technologies*
[2]*Ukrainian State University of Railway Transport*

Effective operation of rail transport as a leading transport industry is based on implementation of innovative rolling stock. And competitive rolling stock implies better engineering-and-economic performance, and also interoperability under certain operational conditions [1 – 3].

As known, one of the most heavily loaded structural units of a train is the automatic coupling device. In operation this unit bears considerable longitudinal dynamic loads achieving 3.5 MN (at shunting impacts). Besides, operational loads greatly impact tracks of main-lines (at braking, taking off, etc.).

A typical automatic coupling device SA-3 ensures coupling of cars and locomotives, places them at a certain distance from each other, and transfers longitudinal forces in trains intended for the 1,520-mm gauge. Nowadays there are modernized models of the device.

It should be mentioned that one of its basic shortcomings is a high cost subject to a great amount of structural elements, such as coupler and absorber).

It requires new models of couplers in service. And they must receive and absorb impact loads, and meet the strength requirements for the carrying structures of rolling stock. It furthers a higher operational efficiency of rolling stock, and decreases costs of unplanned repairs.

Use of the concept coupler mechanism instead of the typical coupling device can decrease the longitudinal dynamic forces in a train under operational modes, including braking ones (Fig. 1). And kinetic impact energy is converted into the viscous force energy. The viscous force is formed by displacement of viscous liquid through the throttle openings of the piston by the principle of hydraulic damper operation. And a brake spring returns the system to its initial state.

It should be mentioned, that the concept coupler mechanism can be implemented for the rail transport means with closed-section center sills. For instance, the engineering solution can be used for trains with carrying elements of circular tubes.

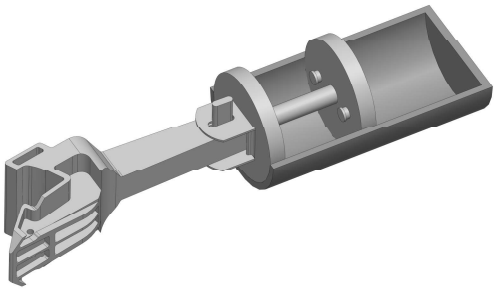

Fig. 1. Concept coupler mechanism

The implementation of the concept coupler mechanism was substantiated with calculations by the method in which the force was defined in the coupler by imaginary division of a train in two parts.

It was considered that a train consisted of 40 cars of the model 12-7023. The 2ТЭ10В model was taken as a locomotive. The train developed 60 km per hour.

The mathematical modeling provided made it possible to define, that under a typical interaction between the locomotives and cars, the acceleration on the cars was about 1.2 m/sec^2. Taking into account the viscous resistance coefficient generated by the concept coupler mechanism, the acceleration was about 0.8 m/sec^2.

Therefore, use of the concept coupler mechanism makes it possible to decrease the longitudinal loading of the train by almost 30% comparing to that under a typical interaction pattern between the locomotive and cars.

Besides, the authors considered the use of elastic frictional interaction instead of viscous interaction.

However, such a pattern for the concept is rather complicated than the first one, and requires some additional elements for generating dry friction force under contraction/tension of the elastic element.

As far as the piston rod of the concept in operational modes bears considerable loads, the authors conducted strength calculations by the finite element method with a spatial model of the adapter with a rod as its component. The graphical works were conducted in SolidWorks. The calculation was implemented in CosmosWorks environment [4, 5].

Isoparametric tetrahedrons were taken as finite elements. The model consisted of 3,792 units and 15,554 elements. The maximum size of an element in the model was 30.8 mm, and the minimum size – 6.16 mm. The percentage of elements with a ratio of sides less than three was 96.9, and more than ten – 0.03.

The loading on the adapter was taken equal to N = 1.2 MN. The structural material was the steel 09G2S. And the maximum equivalent stresses in the adaptor were 269.2 MPa, displacements – 0.5 mm. The maximum deformations were $1.16 \cdot 10^{-3}$. Thus, the adapter capacity was provided [6 – 8].

The research conducted may decrease the longitudinal dynamic efforts and improve the performance characteristics of rolling stock. The results of the research encourage stating the design requirements for innovative rolling stock units at car building enterprises.

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MOTIVATION OF STAFF AS INCREASING MANAGEMENT EFFICIENCY IN UKRAINE

Holovina Yu., Chernetska-Biletska N.
Volodymyr Dahl East Ukrainian National University

The process of personnel management, like any other management process, includes such components as: planning, organization, motivation and control. Personnel management is a single system, and it is difficult to determine the importance of one or another of its components, but with increasing market competition, the function of staff motivation becomes more and more important. Personnel motivation is the process of using internal and external incentives to encourage employees to engage in active activities to achieve one's own and organizational goals. Motives are the internal driving forces of a person that influence the way and results of its activity.

In the context of market relations, the importance of creating a special approach to personnel management is growing. Today, when many processes of theoretical and practical aspects of enterprise organization are being rethought, personnel are the most important resource potential that ensures production efficiency, competitiveness and firm position on the market. Effective use of human resources requires the use of various ways of motivation.

Problems of motivation of work of the personnel of the enterprises were investigated in the works of both domestic and foreign scientists. Significant contribution to the development of theory and practice of motiva-