Utilization of the Adams system for simulating collisions of wagons equipped with elastomeric buffers

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Abstract. The article introduces an innovative method for modeling elastomer buffers using a rheological structure. This approach entails a detailed mathematical description of buffer properties, seamlessly integrated into the ADAMS/Rail computer code for simulating impacts between two wagons. The simulation within ADAMS/Rail provides insights into the dynamic behavior of elastomer buffers during wagon impacts, considering forces, deformations, and overall responses. Serving as a valuable optimization tool for railway system design, this methodology contributes to improved safety and efficiency. The study's comprehensive yet concise insights bridge the gap between theoretical modeling and practical application, enhancing our understanding of elastomer buffer dynamics and their pivotal role in railway operations.

1 Introduction

Research on railway bumpers (buffers) is crucial for ensuring the safety and effectiveness of railway systems. A precise analysis of their buffering properties allows for the design of solutions that effectively absorb energy in the event of collisions, minimizing potential damage and improving overall passenger safety. These studies represent a significant direction for railway engineers, enabling the development of modern technologies that enhance the resilience and efficiency of buffering systems in various operating conditions [1-3].

Elastomers play a crucial role in absorbing energy during the collision of trains for several reasons. Elastic materials, such as elastomers, have the ability to deform under external forces and return to their original shape after the load is removed [4]. This elasticity allows for the absorption of kinetic energy generated during train collisions.

Through deformation, elastomers absorb energy, resulting in a reduction of forces during the collision. This ability to absorb energy translates into a decrease in forces transmitted to the structures of the train cars and passengers. Additionally, the capability of elastomers to absorb energy and deform helps minimize damage to the structural components of train cars during collisions, contributing to overall safety improvements for both the vehicle and passengers.

Elastomers enable a controlled dynamic response during collisions, meaning gradual deceleration and energy absorption rather than abrupt stops. This controlled reaction leads to improved safety conditions for passengers and reduced structural loads on the vehicle [5, 6]. This phenomenon can also be achieved for sandwich composite materials [7].

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