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Study on crashworthiness of wagon's frame under frontal impact

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Abstract

The application of topology, size and shape optimisation for the design of an efficient crashworthy wagon's frame in terms of energy absorption and passenger safety could be developed into a well-practiced discipline. Subjecting the structure of a wagon's frame to this type of development enables the analyst to optimise the size, shape and placement of energy absorber members and triggers using numerical simulation. By understanding the role of each part in deformation and energy absorption during crushing, structural crashworthiness can be achieved with fewer design iterations, therefore leading to reduced cycle times and lower development costs. In a collision, any crushing of the wagon's frame may result in a loss of occupant volume, with the potential for the passenger to be hurt. Besides, a very stiff and inflexible under frame may cause intolerable deceleration and peak force for passengers and overriding of wagons. As a result, localised deformation and tolerable peak force is very important from a crashworthiness point of view in designing of the wagon's frame. This paper presents an insight into the improvement of a ladder-type wagon's frame structure, which is used extensively in Europe and Asia, from the crashworthiness point of view. In this task, a systematic study has been conducted to examine possible strategies to design a crashworthy ladder frame for the passenger wagon train that provides the good features under frontal impact conditions. For this purpose, various combinations of triggers and energy absorber members in one end of a ladder frame are studied

and the improved design is proposed. From crashworthiness point of view, design optimisation can be applied to ensure that material is distributed throughout the structure in an efficient manner to maximise energy absorption and minimise deceleration when a collision occurs.

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Keywords

- crashworthiness,
- wagon,
- ladder frame,
- numerical simulation,
- passenger safety

Details

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