

Crashworthiness, Occupant Protection, And Biomechanics In Transportation Systems--1999: Presented At

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Research on Secondary Impact Safety of Train Driver based on THUMS Dummy

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Abstract. Based on biomechanical Total Human Model for Safety (THUMS) dummy and traditional rigid dummy, the train driver injury of secondary impact in railway crash events is analyzed and the results are compared. The results of THUMS dummy are more detail and comprehensive to describe the injury of train driver. It could be applied to the safety research of crashworthiness of train driver cab in future. The driver injury is serious and needed to be optimized the parameter of cab console to reduce injury risk for the driver in the next work.

1 Introduction

The injury of occupant is very serious in railway crash events, especially for the train driver. There are two main reasons. Firstly, the driver has got injured at the front zone of train. The large plastic deformation will be occurred at the train cab after the train collision and the survival space will be squeezed seriously. Secondly, owing to complicated interior structure of railway cab, the driver could be injured by interior decoration during secondary impact.

Research on railway vehicle crashworthy and occupant secondary impact safety has been developed for many years, and lots of achievements are made [1]-[7]. For example, British Rail developed a series of studies on secondary impact of occupant and passenger compartment structures, and drew up the crashworthiness for interior train structures in vehicle and devised occupant protection standard AV/S19001 [8]-[11]. The Volpe National Transportation Systems Center combined a number of tests with non-linear finite element simulations to research crashworthiness of railway vehicle and the occupant injury impacted with interior structure [12]-[15]. The Japan Railway Technical Research Centre applied multi-body dynamics dummy to research secondary impact in subway [16]. However, the injury of train driver based on THUMS dummy is researched rarely at present.

In this paper, the train driver injury during secondary impact is researched based on THUMS dummy with the more detail and comprehensive injury index by THUMS.

2 Models and methods

2.1 Models

THUMS dummy model is developed by Japan's Toyota motor company (Fig. 1). All organs and skeletons are modeled to simulate body responses in crash. The injury index is more detail and reasonable than the traditional rigid dummy. So THUMS dummy is used in this research to improve some designs of structure and reduce injury of train driver in crash simulation.

The cab console is mainly made up of the equipment cabinet, the driver panel, the pedal and so on. Considering complicated structure, the model is simplified. A lot of equipments which have no effect on secondary impact are omitted (Fig. 2).



Figure 1. THUMS 50 percentile occupant dummy.

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occupant protection, and biomechanics in transportation systems John A. Volpe National Transportation Systems Center Transportation, safety, crashworthiness, occupant protection, rail vehicles. November , ; Nashville, Tennessee, 7. presented at the International Mechanical Engineering Congress and Exposition, Orlando, Florida, November 6, Record - Mechanical Engineering Books, Books. Crashworthiness and occupant protection in transportation International Mechanical Engineering Congress and Exposition, and biomechanics in transportation systems presented at and Exposition: November , , Nashville, Tennessee.ABSTRACT In the U.S. Department of Transportation's Federal Crashworthiness standards are intended to assure that the rail equipment includes features that provide at least a minimum level of protection for the occupants. .. the International Mechanical Engineering Congress and Exposition, November 6.Dry Gas Seal Systems and Failure Prevention. Presented at the ASME Turbo Expo Turbomachinery Technical Conference and Exposition, Charlotte, N.C.Small business proposal writing grant government funding contract consulting strategic plan development engineering technology R&D publications.

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