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FATIGUE ANALYSIS OF STRUCTURE OF GONDOLA CAR BODY BASED ON RIGID-FLEXIBLE COUPLING MULTI-BODY SYSTEMS

Yu-guang Zhong [1]*, Yong Zhan [2]and Ge Zhao [3]

College of Mechanical and Electrical Engineering, Harbin Engineering University,
Harbin 150001, China
e-mail: [1]zhongyuguang@126.com, [2]zhanyong@hrbeu.edu.cn, [3]zhaoge@hrbeu.edu.cn

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With the implementation of the high speed and heavy load policy in the railway freight transportation in China, the increasing using frequency and motivation form the track have heavily impacted on gondola running safety. It is clear that these complex influences can more easily lead to fatigue damage of railway gondola than ever. So, the gondola's fatigue life analysis should be an important part of the design process as well as the main evaluation standard for the new gondola car.

At present, the traditional fatigue life calculation method on railway gondola mainly uses the measured dynamic load and the analysis results of static strength based on finite element method. The method didn't consider the impact of dynamic loads on the gondola structure and it's predicted results can not be accurate. Furthermore, the measured load spectrum should spend costly human and material resources.

To solve the problem, this paper presents a novel method in researching the fatigue life of the gondola car body structure based on finite element method and multi-body system dynamics theory. Firstly, the multi-rigid body system dynamics model of the gondola car is established considering the wheel-rail contact, nonlinear, orbit incentives and other factors. And then the rigid-flexible coupling system dynamics model is established by using structure analysis method. To obtain the ride quality of the gondola car model, simulation calculation is carried out according to the American five level track spectrum and it can be concluded that the rigid-flexible coupling model is more reasonable than the conditional method. To get the accurate the stress time history of the body structure, on the one hand the load time history of gondola car body can be obtained by simulation analysis in a fatigue cycle sample, on the other hand the corresponding quasi-static stress influence factors are calculated in software ANSYS. Through linear superposition of quasi-static stress influence factors and load time histories, the stress time histories of the body structure are acquired in Fatigue analysis software MSC.FATIGUE based on the quasi-static analysis method. On the basis of the method, the paper gets the whole life nephogram of the body structure. The C80B Gondola Car which is designed in China is taken as an example to verify the proposed method, the results show that

the method to predict gondola car body structure based on the combination of the dynamics simulation and finite element analysis is feasible.

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