A study on correlation of derailment coefficient of rolling stock and roll motion measured by motion tracker

Young Sam Ham[1,#]

1 Vehicle and Track Research Department, Korea Railroad Research Institute, #360-1, Woram-dong, Uiwang-si, Gyeongi-do, South Korea, 437-757
Corresponding Author / E-mail: ysham@krri.re.kr, TEL: +82-31-460-5202, FAX: +82-31-460-5814

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The derailment coefficient refers to the ratio of horizontal force(Lateral force) to vertical force (Wheel load), and if the value exceeds a certain level, a wheel climbs or jumps over the rail. That's why the value is used as a criterion for running safety. Derailment coefficient of rolling stocks alters according to shape of rail track. I measured three-dimensional angular velocity and acceleration to use 3D Motion Tracker. Test result, derailment coefficient of rolling stocks and shape of rail track examined closely that have fixed relation. Specially, was proved that Roll Motion has the close coupling relation.

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1. Introduction

One among the core item in which it evaluates the running safety of the rolling stock is the derailment coefficient. The derailment coefficient of the rolling stock changes according to the track shape. There as to the method, evaluating the derailment safety level is the various. The most general method till now using in Korea adheres to the strain gage to a wheel. By measuring the vertical direction load and the lateral direction load in which a wheel receives this method calculates the derailment coefficient. A signal has to be received from the wheel in which it rotates in order to adhere to the strain gage and measure the derailment coefficient. Therefore, the equipment for a signaling from a rotator is essential, it is measurement use wheel and axle. This case, the time and the expenses in which it is many in the strain gage attach, the bridge circuit configuration, the signal tailoring, and etc. are required. Moreover, there is occasion that equipment or gauge is damaged on rotation point, and there are various difficult such as inaccuracy of data by noise. Accordingly, methods that do not attach sensor directly to wheel are studied. That is, a method, and etc. in which we use the method, mounting the displacement sensor to the axle spring and in which it estimates the load as the displacement of the spring the method, in which the vibration acceleration mounts a sensor to the car body and it estimates the derailment coefficient from the vibrational property of the car body the method or the laser sensor, and etc. using the displacement sensor and acceleration sensor are variously studied.[1] In of the Japan and Korea, the method a lateral and vertical direction vibration acceleration of the car body evaluating a characteristic as the running safety of a vehicle is inquired. This considers the affect that the amplitude and frequency of the vibration acceleration reach to the running safety.[2]

In this paper, measure three-dimensional angular velocity and acceleration to use 3D motion tracker, and track shape and derailment coefficient of vehicles wished to clear whether have some correlation. The derailment coefficient of a vehicle and shape of track examined through the main line test that it is operated with the fixed rate. It found out that especially, the roll motion has the most close relation. The method applying in this research is the method epochally reducing the time and cost in comparison with the existing method(adhering to the strain gage to a wheel).

2. Measurement System

Existing measurement system by measuring the derailment coefficient compared with the track shape. The first occurs between wheel and rail interaction to measure the force measuring system to include wireless telemetry system was adopted.[3] Located in front of the train cars all in combination of the balance corresponding to a contraction in the right and left wheels by attaching a strain gauge bridge circuit was wired.

Measuring wheel-set Fig. 1, such as a wireless signal transmitter to send signals to the inside of the wheel with built-in installation and underbody Telemeter transmitter was installed in the signal receiver. Interior of the vehicle, such as data processing devices were constructed by placing the measuring system. Transmitter built-in battery by the signal without a separate power supply to send, and the rotation of the axle so that it can withstand the sturdy construction jigs were installed.[4] The signals from transmitter to receiver via the antenna configured to be stored in the data recorder was passed. That measurements of the track shape of Fig. 2 as a kind of gyroscope sensor was used for 3D Motion Tracker. This digital inertial measurement unit angular velocity and acceleration of a three-dimensional, magnetic field, temperature, etc.. In this study, as a sensor to measure the X, Y, Z 3 direction of the angular velocity and acceleration data were compared with the derailment coefficient.

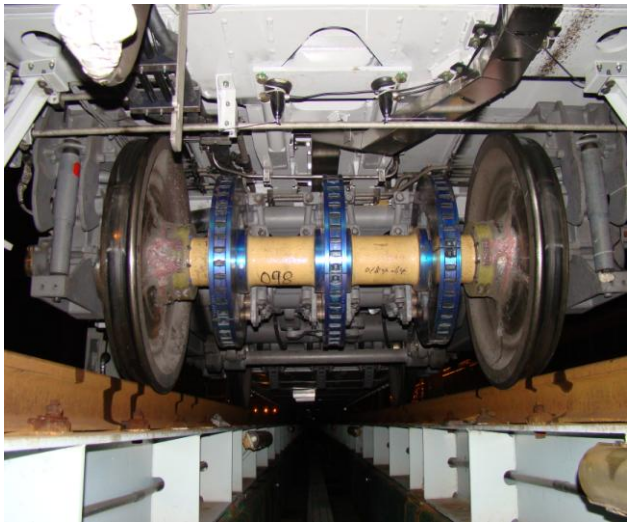

Fig. 1 Telemetry Transmitter & Antenna

Fig. 2 3D Motion Tracker

3. Conclusions

When the vehicle is running at a constant speed, track shape and the derailment coefficient measures the relationship analysis is as follows.

(1) Yawing motion measured the relationship between the track shapes can not be found, it varies with time and the effect of the earth's rotation is expected to be corrected.

(2) Track state(curve radius, cant etc.) the most relevant topics for the vibration of the lateral acceleration and roll motion can be said. Especially, Roll Motion and shape change, wheel load amplification were very well matched as the reproductions.

(3) At a constant speed when driving the same vehicle Roll Motion by changing the track shape can be said that, a ton of changes wheel load about 2(deg / s) of the Roll Motion that could detect changes.

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