A Method to Measure the Pantograph Contact Force on the Overhead Catenary System

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RTRI is developing a method to measure the contact force exerted by all pantographs passing through a specified area where sensors located on the catenary. In this paper, we report the numerical and experimental results of the contact force measurement.

The theory of this contact force measurement method is indicated in Fig. 1. The contact force is calculated from the inertia force of the contact wire, from dropper forces and from the vertical component of the tensile force. The inertia force of the contact wire can be evaluated using accelerometers, and dropper forces can be measured by strain gauges. The vertical component of the tensile force can be calculated from the gradients of the contact wire at both ends of the measurement area by means of two pairs of accelerometers.

An example of the experimental results is shown in Fig. 2. This result indicates that this method can accurately measure the contact force in the frequency range of DC - 15Hz. Using this method, we will quantify the effects of the contact force of the pantograph on the contact wire wear in order to clarify the mechanism of contact wire wear. This measurement method is also useful for pantograph monitoring tools.

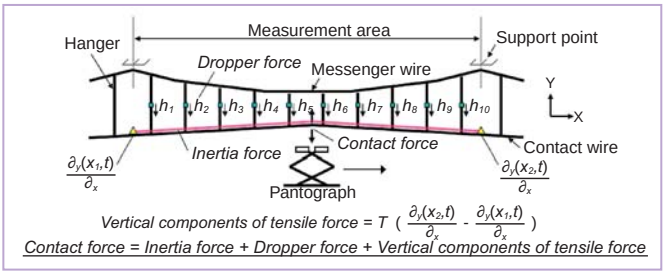

Fig. 1 Contact force measurement in Overhead Catenary System

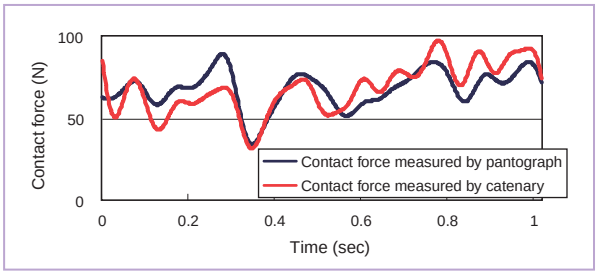

Fig. 2 Measurement results of contact force in experiment

Development of Friction Moderating System to Improve Wheel/Rail Interface in Sharp Curves

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Railway vehicles negotiate sharp curves with large lateral forces interacting between the wheel/rail interface and the angle of attack of the leading axle of a bogie; these forces depend on the bogie's steering performance. In terms of running stability and/or safety, such a large lateral force is one of the main factors contributing to wheel-flange climb derailment at low speeds. In terms of material integrity, it is also a major cause of low rail corrugation, thin flange wear of the wheel and gauge face wear of the rail, and as an environmental issue it is a particular cause of the squealing noise found on urban railways.

In the last decade, there has been a focus on lubrication of the interface between the wheel tread and the top of the low rail to reduce large lateral forces at the wheel/rail interface, to reduce low rail corrugation and to mitigate wheel squeal. However, such lubrication involves a certain risk of wheelslide due to the low traction coefficient it causes, which demands that the friction in the interface is appropriately controlled. RTRI has developed a friction moderating system (FRIMOS) that consists of a solid lubricant called a friction moderator, a device installed on the vehicle that applies the friction moderator to the wheel tread/top of the low rail interface and an application control system. The friction moderator is a solid dry lubricant and is made of carbon. The moderator application device is used to deliver a jet of the friction moderator to the interface between wheel and rail. The application control system allows adjustment for optimal delivery of the friction moderator in terms of timing and volume together with a curve detection system.

The effect of FRIMOS in reducing lateral forces was investigated in running tests using a vehicle equipped with FRIMOS, and the friction moderator was applied only to the low rail side of the track. Figure 1 shows the results of lateral forces of the low rail and high rail as measured at the track site. In the figure, the reduction of lateral forces achieved by use of the friction moderator is apparent.

A further study of an automatically controlled system for applying the friction moderator is expected to provide practical information on optimal timing and volume of the application, and it will also identify the potential of the friction moderator to prevent corrugation forming on low rail during a long period of operational service.

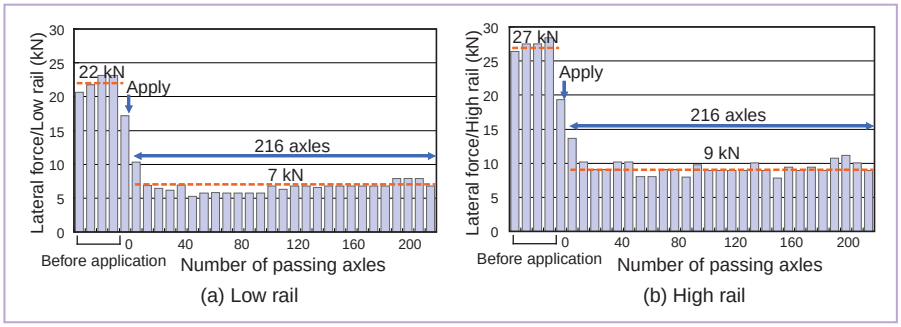

Fig. 1 Effect of the friction moderator on decreasing lateral force