Stability Analysis of Pantograph Under Sliding Condition Based on Excitation Test

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When railway vehicles run at low speeds, unstable vibrations may occur on the pantograph due to the high coefficient of friction. In order to reduce the maintenance cost of the contact strips, there is a need for a method to analyze the stability of the pantograph taking the friction coefficient into account. Stability analysis can be performed by constructing an analytical model of the pantograph, but building such a model requires high costs. Therefore, this study proposes a method to analyze the stability using the measurement of the frequency response function (FRF) of the pantograph when the vehicle is stationary. Since this method predicts the FRF in the sliding state, the construction of an analytical model is not required. In this method, the FRF is measured by exciting the contact strips, and the FRF in the sliding state is estimated by assuming a friction coefficient. Modal characteristics are identified using the estimated FRF, and stability analysis is performed using positive or negative damping ratios. The validity of the results of this analysis was verified by comparing them with the results of the low-speed sliding tests of the pantograph.