

Analytical study on effect of Sliding Friction on Unstable Vibration of Pantograph

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Sliding of the pantograph head and contact wire causes frictional force acting on traveling pantograph head in horizontal direction. If the coefficient of friction between the pantograph head and contact wire is large, unstable vibration of the traveling pantograph could be observed. To analyze this vibration, a 2 -dof pantograph model considering frictional force acting on the pantograph head has been proposed. However, stability of the contact strip attached to the pantograph is not studied in this model. Therefore, this study proposes two types of a 2-dof contact strip model for the cases where the contact strip slides on rigid contact bar or overhead contact line. This 2 -dof contact strip model considers vertical and pitching direction movement. In addition, a stability analysis method using the 2-dof contact strip model is also proposed. In this method, we apply the complex eigenvalue analysis to the 2-dof contact strip model. Furthermore, excitation test of actual contact strip for Shinkansen train was carried out to identify its dynamic characteristics. Then mode shapes and natural frequencies of the contact strip were identified by utilizing the Maxwell's reciprocal theorem. Moreover, the stability analysis based on the complex eigenvalue analysis was carried out using identified modal parameters.