عنوان مقاله:

Estimation of Wheel-Rail Adhesion Force Using Traction System Behavior

محل انتشار:

مجله نوآوری های مهندسی برق و کامپیوتر, دوره 12, شماره 1 (سال: 1403)

تعداد صفحات اصل مقاله: 12

نویسندگان:

.M. Moradi - *Faculty of Electrical Engineering and Computer, University of Birjand, Birjand, Iran*

.R. Havangi - *Faculty of Electrical Engineering and Computer, University of Birjand, Birjand, Iran*

خلاصه مقاله:

kground and Objectives: Traction system and adhesion between wheel and rail are fundamental aspects in rail transportation. Depending on the vehicle's running conditions, different levels of adhesion are needed. Low adhesion between wheel and rail can be caused by leaves on the line or other contaminants, such as rust or grease. Low adhesion can occur at any time of year especially in autumn, resulting in disruptions to passenger journeys. Increased wheel-rail adhesion for transit rail services results in better operating performance and system cost savings. Deceleration caused by low adhesion, will extend the braking distance, which is a safety issue. Because of many uncertain or even unknown factors, adhesion modelling is a time taking task. Furthermore, as direct measurement of adhesion force poses inherent challenges, state observers emerge as the most viable choice for employing indirect estimation techniques. Certain level of adhesion between wheel and rail leads to reliable, efficient, and economical operation.Methods: This study introduces an advantageous approach that leverages the behavior of traction motors to provide support in achieving control over wheel slip and adhesion in railway applications. The proposed method aims to enhance the utilization of existing adhesion, minimize wheel deterioration, and mitigate high creep levels. In this regard, estimation of wheel-rail adhesion force is done indirectly by concentrating on induction motor parameters as railway traction system and dynamic relationships. Meanwhile, in this study, we focus on developing and applying the sixth-order Extended Kalman Filter (EKF) to create a highly efficient sensorless re-adhesion control system for railway vehicles.Results: EKF based design is compared with Unscented Kalman Filter (UKF) based and actual conditions and implemented in Matlab to check the accuracy and performance ability for state and parameter estimation. Experimental results showed fast convergence, high precision and low error value for EKF.Conclusion: The proposed technique has the capability to identify and assess the current state of local adhesion, while also providing real-time predictions of wear. Besides, in combination with control methods, this approach can be very useful in achieving high wheel-rail adhesion performance under variable complex road conditions

کلمات کلیدی:

Extended Kalman Filter, Adhesion Model, Railway Traction, Torque, Estimation