

A new estimation of nonlinear contact forces of railway vehicle

ABSTRACT

The core part of any study of rolling stock behavior is the wheel-track interaction patch because the forces produced at the wheel-track interface govern the dynamic behavior of the whole railway vehicle. It is significant to know the nature of the contact force to design more effective vehicle dynamics control systems and condition monitoring systems. However, it is hard to find the status of this adhesion force due to its complexity, highly non-linear nature, and also affected with an unpredictable operation environment. The purpose of this paper is to develop a model-based estimation technique using the Extended Kalman Filter (EKF) with inertial sensors to estimate non-linear wheelset dynamics in variable adhesion conditions. The proposed model results show the robust performance of the EKF algorithm in dry, wet/rain, greasy, and fully contaminated track conditions in traction and braking modes of a railway vehicle. The proposed model is related to the other works in the area of wheel-rail systems and a tradeoff exists in all conditions. This model is very useful in condition monitoring systems for railway asset management to avoid accidents and derailment of a train.