

A Chassis Load Dynamic Estimation Method for Distributed Drive Electric Loaders[⊖]

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Abstract: To solve the problem that the chassis load of loaders is difficult to obtain, a chassis load dynamic estimation method for distributed electric drive loaders is presented in this paper. Firstly, according to the characteristics of the external load, two estimation modes for the bucket's external load are presented, which are based on longitudinal load and Center of Gravity (COG) of the material respectively. Secondly, considering the influence of material flow on identification of material's COG position and mass parameter, Variable Forgetting Factor Recursive Least Squares (VFFRLS) algorithm is employed. And then, the vertical load of loader chassis is calculated by analyzing the straight shoveling operation. Finally, to verify the algorithm in this paper, co-simulation of Adams and EDEM is used to generate the reference curve. The results show that VFFRLS can enhance the convergence speed with improving accuracy to some extent, and is more suitable for the identification of material parameters in loader operations. Compared with the results of co-simulation, the Normalized Root Mean Squared Error (NRMSE) of front and rear wheel load is 2.48 % and 4.60 %, respectively. Therefore, the effectiveness of the algorithm is verified. This research provides a basis for distributed electric drive system control and automatic operation of loaders.

Key words: distributed drive electric loaders, bucket external load, chassis load, VFFRLS, co-simulation

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