

3D Frictionless Contact Case between the Structure of E-Bike and the Ground

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Abstract : China is currently the world's largest producer and distributor of electric bicycle (e-bike). The increasing number of e-bikes on the road is accompanied by rising injuries and even deaths of e-bike drivers. Therefore, there is a growing need to improve the safety structure of e-bikes. This 3D frictionless contact analysis is a preliminary, but necessary work for further structural design improvement of an e-bike. The contact analysis between e-bike and the ground was carried out as follows: firstly, the Penalty method was illustrated and derived from the simplest spring-mass system. This is one of the most common methods to satisfy the frictionless contact case; secondly, ANSYS static analysis was carried out to verify finite element (FE) models with contact pair (without friction) between e-bike and the ground; finally, ANSYS transient analysis was used to obtain the data of the penetration $p(u)$ of e-bike with respect to the ground. Results obtained from the simulation are as estimated by comparing with that from theoretical method. In the future, protective shell will be designed following the stability criteria and added to the frame of e-bike. Simulation of side falling of the improved safety structure of e-bike will be confirmed with experimental data.

Keywords : frictionless contact, penalty method, e-bike, finite element

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