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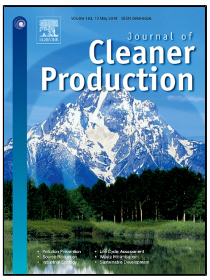

Multidisciplinary optimization of electric-wheel vehicle integrated chassis system based on steady endurance performance

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Multidisciplinary optimization of electric-wheel vehicle integrated chassis system based on steady endurance performance[1]

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Abstract This paper presents a brand-new chassis system for an electric-wheel vehicle, comprising differential-assisted steering, hub motor driving, and semi-active suspension systems. The three subsystems interact and are coupled with each other. All three codetermine the comprehensive performance of the entire vehicle. Therefore, the integrated optimization of electric-wheel vehicle chassis systems needs to be carried out based on the considerations of the coupling relationships among the three subsystems. In this study, the dynamic model of the integrated chassis system is established. Based on the specific quantitative formulas of the steering road feel, steering sensitivity, semi-active suspension riding comfort, steering energy consumption, and driving energy consumption, the comprehensive evaluation index "Steady Endurance Performance (*SEP*)" is introduced for electric-wheel vehicles. In addition, this study proposes the multidisciplinary optimization method of bi-level integrated system collaborative optimization (BLISCO) for electric-wheel vehicle integrated chassis systems to improve the accuracy of the optimization and avoid limitations pertaining to local optimal solutions. The optimization results show that the BLISCO method can not only improve the convergence of the Pareto solution set and the accuracy of the multidisciplinary optimization results of the integrated chassis system, but can also effectively enhance the handling stability, steering portability, riding comfort, and economical efficiency of the entire vehicle to guarantee the vehicle's endurance under conditions of steady driving.

Keywords Steady endurance performance; Electric-wheel vehicle; Integrated chassis system; Multidisciplinary optimization

1. **Introduction**

The electric-wheel vehicle is driven by four independent hub motors that have fast responses and independently controlled output torques. This driving mode avoids complicated transmission mechanisms, improves transmission efficiency, reduces emissions, and makes it beneficial to the layout of vehicle space [1–3]. The electric-wheel vehicle has a brand-new chassis system, including the differential-assisted steering, hub motor driving, and semi-active suspension systems. The three subsystems interact with each other and codetermine the comprehensive performance of the entire

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