Vehicle motion control and energy optimization based on Q-learning for a four-wheel independently driven electric vehicle

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Abstract—With the rapid development of vehicle autonomous and electrification, vehicle motion control is the basis for vehicle intelligence. This study presents an optimization control strategy for the powertrain system of a four-wheel independently driven electric vehicle to improve the dynamic stability and energy saving performance of a four-wheel independently driven electric vehicle. Firstly, vehicle parameters are identified according to actual vehicle data. The vehicle traction torque is calculated according to the vehicle dynamics equation. Then, with the goal of reducing the body vertical motion, vehicle energy consumption and deviation from the reference speed, the vehicle traction torque is split based on a Q-learning algorithm to achieve vehicle stability control and improve vehicle economy.

Index Terms—electric vehicle, motion control, energy optimization, Q-learning, multi-objective optimization