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Integrated Motion Control of Four in-Wheel Motor Actuated Vehicles Considering Path Tracking, Ride Comfort, and Energy Efficiency

Myeongseok Ryu, Yuhwan Shin, Seunghoon Jang, and Kyunghwan Choi

Abstract— **Many efforts have been made to design motion control methods for the path tracking of autonomous vehicles while satisfying vehicle stability. However, considering ride comfort and energy efficiency in motion control methods is still challenging. This poster presents a motion control method for an autonomous electric vehicle, which can consider path tracking, energy efficiency, and ride comfort in an integrated framework. The proposed method consists of a model predictive controller for path tracking, a vertical body motion stabilizer for enhancing ride comfort, and a torque vectoring controller for minimizing energy consumption. The vertical body motion stabilizer determines the longitudinal and lateral acceleration ranges that stabilize the pitch and roll dynamics. These ranges are used as constraints in the model predictive controller that determines optimal values of the steering angle and longitudinal tire forces for minimizing the tracking error. The torque vectoring controller distributes the longitudinal tire forces to each wheel torque and determines the optimal distribution for minimizing energy consumption. The proposed control method is validated using a four-in-wheel motor-actuated vehicle under two challenging scenarios. The validation results demonstrate that the proposed control method provides satisfactory performance in path tracking, ride comfort, and energy efficiency, even under harsh operating conditions with many road bumps.**

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Myeongseok Ryu, Yuhwan Shin, Seunghoon Jang, and Kyunghwan Choi (corresponding author) are with School of Mechanical Engineering, Gwangju Institute of Science and Technology, Gwangju 61005, South Korea dding_98@gm.gist.ac.kr, yuhwan99@gm.gist.ac.kr, shjang7071@gm.gist.ac.kr, khchoi@gist.ac.kr

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