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Robust Learning-Based Predictive Motion Control for Four In-Wheel Motor Drive Electric Vehicles

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Abstract— **This poster proposed a novel predictive motion control method for in-wheel motor drive electric vehicles, encompassing vehicle stability, ride comfort, and power consumption. The control structure comprises two levels: two upper-level controllers and a lower-level torque allocation coordinated controller. For the upper-level, a longitudinal motion controller based on active disturbance rejection control (ADRC) is designed considering vehicle pitch motion. Moreover, an integrated lateral controller based on Model Predictive Control (MPC) is constructed considering vehicle lateral stability and rollover stability. For the lower-level, a torque allocation coordinated controller to distribute four-wheel torques, which can coordinate tracking performance, vehicle stability and energy consumption. Subsequently, curriculum learning (CL) is applied to adjust torque distribution coefficient to obtain the optimal vehicle handling control strategy. Ultimately, the efficacy of the proposed control method is thoroughly validated via simulation experiments using high-fidelity Modelon vehicle models across various driving scenarios.**

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