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Combination of Skid Control and Direct Yaw Moment Control to Improve the Safety and Stability of the Small Electric Vehicle with Two In-Wheel Motors

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Abstract. For a small electric vehicle (EV) with the rear two in-wheel motors, the hydraulic brake system and the mechanical brake system are installed at the front and rear tire respectively. The mechanical brake system is used at the rear tire because there is no enough space for the hydraulic brake system. In a braking condition, the in-wheel motor at the rear tire will generate the regenerative braking force and it can improve the braking performance of the vehicle. However, during braking on the low adhesion road surface, anti-lock brake system (ABS) is very crucial to prevent the tire from lock-up. To improve the safety and stability of the vehicle, the combination of anti-skid control system and direct yaw moment control system is proposed. The anti-skid control system contains a hydraulic unit of ABS at the front tires and regenerative brake timing control at the rear tires. The control method of the regenerative brake timing control is same as ABS and it will turn on and off to prevent the tire from lock-up. On the other hand, the direct yaw moment control system is developed to increase the steer performance of the vehicle. The optimal control is used as the control strategy method to control the yaw moment. The simulation is developed in MATLAB Simulink and the result shows that the proposed model can improve the stopping distance from 9 seconds to 8.2 seconds. In addition, the combination of skid control and yaw moment control also improved the steer performance of the vehicle.

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