

Modelling and validation of an electronic wedge brake system with realistic quarter car model for anti-lock braking system design

ABSTRACT

With the advancement in battery and electronics technologies, soon Electric Vehicles (EV) will replace traditional vehicles as they are more efficient and environment friendly. This will require replacement of all mechanical systems in vehicles with their electrical counterparts. This study focuses on electromechanical brakes (EMB) as replacement of hydraulics brakes. Particularly a type of EMB known as Electronic Wedge Brake (EWB) which uses wedges to create self reinforcing braking force and consume less power than other EMBs. Detailed mathematical model of an EWB system is presented which provides braking force and torque to the disk brake. A Quarter Car Model (QCM) with realistic parameter values and aerodynamic deceleration is modelled to validate the EWB system. The system is validated for different road conditions and anti-lock braking system (ABS) is demonstrated for snowy road using a single PID controller. The results validate the brake and car model and a need for cascaded control strategy to implement ABS is established.

Keyword: Anti-lock braking system (ABS); Electric vehicle (EV); Electronic wedge brake (EWB); Quarter car model (QCM); Slip