

Analysis of Cascade Control Structure in Train Dynamic Braking System

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Abstract : In recent years, increasing the usage of railway transportations especially in developing countries caused more attention to control systems railway vehicles. Consequently, designing and implementing the modern control systems to improve the operating performance of trains and locomotives become one of the main concerns of researches. Dynamic braking systems is an important safety system which controls the amount of braking torque generated by traction motors, to keep the adhesion coefficient between the wheel-sets and rail road in optimum bound. Adhesion force has an important role to control the braking distance and prevent the wheels from slipping during the braking process. Cascade control structure is one of the best control methods for the wide range of industrial plants in the presence of disturbances and errors. This paper presents cascade control structure based on two forward simple controllers with two feedback loops to control the slip ratio and braking torque. In this structure, the inner loop controls the angular velocity and the outer loop control the longitudinal velocity of the locomotive that its dynamic is slower than the dynamic of angular velocity. This control structure by controlling the torque of DC traction motors, tries to track the desired velocity profile to access the predefined braking distance and to control the slip ratio. Simulation results are employed to show the effectiveness of the introduced methodology in dynamic braking system.

Keywords : cascade control, dynamic braking system, DC traction motors, slip control

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