

Fuzzy Logic Cascaded Current Control of DC Motor Variable Speed Drive using dSPACE

Abstract

Two-wheel e-scooter falls under low power segment for Battery Electric Vehicle (BEV) and has gain more popularity in urban commuting. Most entry level e-scooter is still powered by DC motor due to low cost and ease of control. However basic open-loop DC Motor control employed through throttling is plugged with limited efficiency, precision, and range of speed control. Closed-loop control enables real time adjustment according to preset speed which becomes handy during auto cruising. To ensure good dynamic response, improved robustness and stable wide speed control range, a good control scheme for the motor is essential. In this project, a variable speed control scheme, namely fuzzy logic cascaded current control system was designed using MATLAB Simulink, comprising speed control loop and a current control loop 185 W Separately Excited Brushed DC Motor. The proposed control system was tested on hardware using dSPACE DS1104 platform. The system's output speed is obtained using an incremental encoder, while the output current is measured with a current sensor. Subsequently, the control system's stability, robustness, and dynamic performance were evaluated by driving the system on 120 W electrical load at varying speed. The system performance has proved superior to closed-loop by 70% on low speed ripple reduction and is on par with PI cascaded current control scheme.

Keywords

Cascaded Current Control; Fuzzy Logic Control; Variable Speed Drive