Improved direct torque control load torque estimator with the influence of steering angle for dual induction motors electric vehicle traction drive system

ABSTRACT

Front-wheel direct-driven dual motors of an electric vehicle (EV) with a single controller configuration offer great potential and flexibility for improving system performance, efficiency and safety. The objective of the paper is to design a new load torque estimator of Direct Torque Control (DTC) by merging the electrical model with the mechanical model of an EV traction system to improve the dual motors single controller configuration. The electrical model utilise Space Vector PWM (SVPWM) DTC control of dual induction motors fed Five-leg Inverter (FLI) while the mechanical model takes the 14DOF vehicle dynamic model as its main structure. The new technique used is by integrating lateral force with longitudinal force produced at the touch point of a tyre with road surface as the input to the new load torque estimator of DTC. The new load torque estimator technique results were, then, compared with the standard load torque estimator that used the voltage and current feedback only. The findings showed that while torque estimator of conventional DTC had no effect of steering angle on the speed, torque and current performance of the motors, the new load torque estimator showed a significant impact. The speed, torque and current responds of the motors now have precisely been estimated; following the trajectory of the steering angle. Hence, for future research the new load torque estimator with the accurate and precise speed and torque response can further be utilized in stability, slip and skid and traction control or even for electronic braking system.

Keyword: Traction control; Direct torque control (DTC); Multi-machine single converter; Load torque estimator; EV modelling; Electric differential