Implementation of Model Predictive Control for Permanent Magnet Synchronous Round Motor: Heavy-Duty Vehicular Application

Dr. Nursaid Polater
Yozgat Bozok University, Yozgat, Turkey

Abstract

This research study investigates the design of model predictive control (MPC) for permanent magnet synchronous round machines (PMSRM), employed for heavy-duty vehicular applications. PMSRMs have remarkable potential owing to their power density and efficiency. The target of this study is to explore the MPC method for a particular PMSRM that has parameters of a typical light railway traction motor. Besides, a benchmarking of the PMSRM and MPC model, dynamic analysis of the motor is presented with simulation results. Based on the aim, the MPC algorithm is modelled and implemented in MATLAB/Simulink software tool then the results are compared with traditional field-oriented control (FOC) at the end of the article. According to simulation results, MPC increases torque smoothness and drastically lowers the current ripple, increasing the robustness and energy efficiency. By modifying predictive control for high-inertia, rail-specific PMSRMs, this study advances the field and aids in the implementation of low-carbon railway transport projects.

Index Terms

Field-Oriented Control, Heavy-Duty Electric Vehicles, Model Predictive Control, Permanent Magnet Round Synchronous Motors