Abstract:

Recently, interior permanent magnet synchronous motors (IPMSMs) are becoming more used due to the powerful magnetic characteristic of the rare earth, being used in different areas. Several researchers have proposed implementations combining the use of IPMSM with the direct torque control (DTC) technique offering a quick and precise control. However, DTC can provide only for torque and flux control, the speed controller is also needed to design for high performance of ac motor. The design of the speed controller greatly affects the performance of an electric motor. A common strategy to control an IPMSM is to use direct torque control combined with a PI speed controller. These schemes are not capable to fulfill the requirements of high performance because elimination of steady-state error and overshoot problems and the rejection of load disturbance cannot be achieved simultaneously. This paper proposed a discrete-Time PI (DTPI) controller to control the speed of DTC IPMSM to replace conventional PI controllers to improve the IPMSM performance. In order to obtain the stable performance of speed of IPMSM, the gains of designed DTPI controller are chosen by choosing the proper value of poles. Moreover, the chosen gains of DTPI controller confirm that the steady state error and the overshoot problems can be minimized and the controller becomes robust against the disturbance of load torque. The effectiveness of our propose DTIP controller to control speed of IPMSM incorporated with DTC method is verified by Matlab/Simulink software. It is seen from simulation works that the performance of DTPI controller is better as compared with the conventional proportional integral (PI) controller.

Keywords: Direct torque control; Speed control; PI controller; Discrete-time PI controller; Interior permanent magnet synchronous motor