Analysis of Torque Ripple in Vector Control of BLDC Motor using SVPWM Technique

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Abstract:
Industrial generally needs low oscillations in motor output. As compared to other motors the BLDC motor has more advantages and used in more applications. The torque ripples and speed control in motors are playing a key role in application. So definitely, there is a need to reduce the oscillations and control the speed in closed loop operated BLDC motors. This paper presents the PI, fuzzy controller for reducing the torques ripples and also for speed control of BLDC motor. Pulse width modulation (PWM) generation and subsequent switching can reduce oscillations in torque content. For accurate results mathematical modelling is required to design in simulation model. The simulation models of mathematical modeling, Space vector Pulse width modulation operated BLDC with PI & fuzzy control and the results are also presented.

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I. Introduction

The electronic commutator controls the commutation of BLDC motor, but the normal DC motor will have mechanical commutator. According to the rotor position sensor the signal is sent to the controller to switch the stator winding [1–2]. The BLDC motor has a quite low noise level, high speed-torque characteristics, more reliable, compact size and less maintenance. Hall Effect sensor has been employed to sense rotor position and send the signal effectively and this is connected to stationary part of the motor [3] –[5]. Both induction and BLDC motor has similar stators. Both drives use 3-phase modulating inverters. The rotors and the inverter controls parts made difference between them. BLDC motor drives require an absolute position sensor, but the induction motor drives require only a speed sensor. The exact position of the rotor can be achieved by sequence excitation of stator winding and rotor magnet poles. Due to less inertia of motor it is easy to control. The stator of this motor wound such that it gives trapezoidal back emf [4] –[6]. The hall sensor is embedded with rotor poles to give exact rotor position. For better commutation exact phase shifting is required with alternate N and S poles.PWM decoding signals requires ON and OFF conditions which fed by rotor position sensor to get accurate rotor position [7–8]. The commutation sequences and the motor performances are also decided by rotor position. The inverter gets the pulses from the PWM current controller and fed to BLDC motor. The pulse width modulation method is used to improve motor performance and also reduce the oscillations [9] –[11]. The BLDC motor drive mathematical modeling, control scheme and simulat ion models are presented In this paper simulink model of PI and fuzzy controllers with closed loop control of BLDC for reducing torque ripples are presented.

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