**Analysis and Minimization of Torque Ripples in BLDC Motor**

Recently, the brushless DC (BLDC) motor and the permanentmagnet synchronous motor (PMSM) have been receivinga great deal of attention because of their inherent advantagesof high power density, high efficiency, a large torque to inertiaratio, high starting torque, free maintenance, and ease ofcontrol. Generally, a BLDC motor has a trapezoidal electromotive force (EMF) waveform, so the current waveform ofa BLDC motor has a square waveform to reduce torqueripple. Therefore, a BLDC motor controller requires alow resolution position sensor and only one current sensor.On the other hand, since a permanent magnet synchronousmotor (PMSM) has a sinusoidal EMF waveform, the currentwaveform of a PMSM must be sinusoidal. As a result, aPMSM requires an expensive high resolution position sensorsuch as an absolutely encoder and resolver. Therefore, a BLDCmotor is generally used for low-cost applications due to itsease of control, and its low cost position and current sensors.

Brushless dc (BLDC) motors are rapidly gaining popularity from mid 80’s. The BLDC motor is the most suitable motor in application field with requiring fast dynamic response of speed, because it has high efficiency and can be easily controlled in a wide speed range. BLDC motor has linear torque to current and speed to voltage relations similar to dc motor. BLDC motor has trapezoidal emf and quasi-rectangular current waveforms. In the BLDC motor, the torque ripple is decided by the back emf and current waveforms, and their non-ideal effects generate a pulsating torque. The reduction of the torque ripple is important from a speed and position control point of view.

Theoretically, the current made by source voltage instantly rise to steady state limited by a resistance and the torque is produced without torque ripple. However, the current characteristic of the actual BLDC motor is different from the ideal case. Since the current is influenced by the inductance and resistance, the current has a time constant and cannot rise or fall to the steady state instantly and leads to current ripple. The torque ripple is affected by current ripple directly when the back emf has the trapezoidal waveform. The conventional control methods of BLDC motor lead to great commutation torque ripples, which is primarily caused by commutation of phase currents.

The objectives of this thesis are as follows

1. Critically evaluating the various torque ripple minimization algorithms viz. Current Control algorithm, variable input voltage etc.
2. Implementation of variable input algorithm by different drive topologies.
3. Comparison of torque ripple with three level inverter and multilevel inverter drives
4. Development of component reduced MLI suitable for BLDC motor
5. Development of novel PWM strategies for torque ripple minimization

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