ABSTRACT

Switched Reluctance Motor (SRM), the doubly salient, singly excited motor has a simple and robust construction. Although, the induction motor is still the workhorse of the industries, the promising feature of the high torque to mass ratio, high torque to inertia ratio, low maintenance, high specific output and the excellent overall performance of SRM makes it an efficient competitor for AC drives.

Direct Torque Control (DTC) has many promising features and advantages such as absence of speed and position sensors, absence of coordinate transformation, reduced number of controllers and minimal torque response time. In addition, there are many limitations that need to be investigated. A major concern in direct torque control of SRM drives is torque and flux ripples, since none of the switching vectors is able to generate the exact stator voltage required to produce the desired changes in torque and flux. So the reduction of torque and flux ripples is the major role in this work.

The objective of the work is to minimize the torque ripple in direct torque control of switched reluctance motor drive using multiple voltage space vectors. In this thesis, two methodologies have been introduced to increase the voltage space vectors. One is by increasing the number of phases of SRM (Multi-phase SRM) and other is implementation of Discrete Space Vector Modulation (DSVM) techniques.
High phase number drives possess several advantages over conventional three phase drives such as reducing the amplitude, increasing the frequency of torque pulsations, reducing the rotor harmonic currents, reducing the current per phase without increasing the voltage per phase, lowering the dc link current harmonics and higher reliability. By increasing the number of phases it is also possible to increase the torque per rms ampere for the same volume machine. Due to increased switching frequency, increased phase number leads to increased commutation torque ripple frequency, thus making its filter easier.

Discrete Space Vector Modulation (DSVM) is based on the idea that new voltage vector is obtained by synthesizing higher number of voltage space vectors than which is used in the classical DTC technique. This can be made possible by dividing the sampling time into N equal intervals and applying various voltage vectors in each of them. By doing this, many new equivalent voltage vectors can be synthesized. The more the voltage vectors, the more convenient it is to select voltage vectors for various speeds to reduce the ripples of the torque and flux.

Matlab/Simulink model is constructed and these two methodologies are implemented for Switched reluctance motor drive. The simulation results validate the work with minimization of torque and flux ripples.