Analysis of electromagnetic field and control experiment planning for permanent - magent synchronous motors

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ABSTRACT

In recent years, the permanent magnet synchronous motor had been applied to speed control gradually. Normally, they are driven by six-step square wave drive, Sinusoidal Pulse Width Modulation (SPWM) or Space Vector Pulse Width Modulation (SVPWM). The advantage of six-step square wave to drive permanent magnet synchronous motor includes low switching losses and do not need accurate rotor position feedback, but it will brings large torque ripple. If used Sinusoidal Pulse Width Modulation will get smaller torque ripple, but it need more accurate rotor position. The operate theorem of Space Vector Pulse Width Modulation use three-phase PWM converter basic voltage vectors to synthesize the stator voltage vector, the stator voltage vector act on stator coil produced stator flux vector, and then interact with the rotor flux result torque to drive motor. The harmonic current of space vector pulse width modulation more low and scattered than sinusoidal pulse width modulation significantly, thus have low harmonic loss and low torque ripple. Through arrange the states of two zero stator vectors 000 and 111, and combine with six non-zero stator vectors to synthesize the circular trajectory voltage vector control signals, it will reduce the switch frequency of device and improve the voltage utilization simultaneously. This study is research to analysis of electromagnetic field and control experiment planning for permanent magnet synchronous motors. Here used TI TMS320 F2812 digital signal processor (DSP) as controller core, and with VisSim / ECD DSP rapid development system to make an embedded controller experiment. Then using finite element analysis software JMAG to analyze the finite element of motor models and simulate magnetic circuit, the results will as the experiment planning references. Finally, compare the simulate results waveform and actual measurements waveform to verify the accuracy between simulation and measurement. And experiment with different control methods are used to observe the adjust parameters of controller how to affect on system response.

Keywords : Permanent Magnet Synchronous Motor (PMSM)、Finite Element Analysis、Permanent Magnet、Magnetic Circuit 、Permanent Magnet Synchro

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