E.ENG.17

LOW FREQUENCY PERFORMANCE IMPROVEMENT OF PWM INVERTER

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In recent years, due to development of fast switching power devices, the pulse width modulated (PWM) inverter has become one of the most popular power conversion apparatuses. Hence much research is done on the performance of PWM inverters around low frequencies. In this paper, voltage distortion is discussed with special emphasis on the voltage drop effect of power devices at different frequencies. Methods for compensating the dead time, saturation voltage drop and voltage boost at low frequencies are presented. This method helps the general purpose PWM inverter to synthesize more accurate output voltages.

As the first strategy, it provides a method to regulating motor voltage in order to operate the motor with desired speed/torque curve. In this proposed method, it uses fixed boost where the control scheme is based on the popular constant volts per hertz method. It applies a voltage boost such that at the low frequencies motor is still operating full load torque by keeping the magnitude of the stator flux constant.

In order to prevent the short circuit of the power supply in PWM voltage, insertion of dead time is essentially needed. Although it guarantees safe operation, it adversely affects the performance of the inverter, causing deviations from the desired fundamental output voltage. Therefore, proper compensation of dead time is important. In this research, the dead time compensation is achieved by a correction method called voltage pulse based strategy.

In addition to dead time effect in PWM inverters, output waveform distorts due to saturation of power devices. This paper introduces a novel method to eliminate effect of power device saturation which eliminates saturation effect by lengthening the pulse which is affected by the saturation effect.

The simulation has been carried out in POWERSIM simulation environment with experiment dead time of 2μs. Effectiveness of proposed dead time correction method is evaluated by obtaining the voltage integration over time. Moreover the current wave forms were also observed and it could be seen that the current distortion has been lessened due to compensation. The improvements by using voltage boost are obtained by taking the Total Harmonic Distortion. The performances of compensating the effects of saturation voltage drop are illustrated through taking the waveforms of torque ripple and volt-sec integration.

Through the observations, it can be concluded that the saturation of power devices is dominant in low frequencies and the method we presented was capable of minimizing this effect.