

1-Abstract

"Inverters Using Pulse Frequency Modulation"

This thesis investigates the inverters using pulse frequency modulation (PFM). The inverter operation depends mainly on the associated control and drive circuits. Moreover, digital control circuits are preferred to analog circuits because of its simplicity and their high speed and high accuracy. First, computer simulation is performed to generate three Phase PFM signals via a parallel port of the PC, to study the effect of different PFM parameters on the inverter output voltage harmonic content, and choose the most suitable parameters for practical implementation, then a three Phase PFM inverter is completely constructed and tested to drive an AC motor.

A computer program is constructed to simulate PFM patterns under different conditions. The simulation of PFM is more valuable in studying the harmonic content of PFM than referring to a complicated mathematical expression of PFM, since the conditions of overmodulation and overlapping are included in the program. The simulation results showed the effect of different factors on the harmonic content of the PFM inverter output voltage and to choose the most suitable parameters for practical implementation. These factors are the carrier frequency, the pulse width, the reference wave frequency, and the amplitude of the reference wave. According to this study the most suitable values of the PFM parameters are selected. A practical implementation is carried out, where a three phase variable voltage variable frequency inverter using PFM, and its associated circuits are designed and implemented to drive a three phase induction motor.

Each circuit is tested separately, then the overall system are tested when fed a three phase induction motor. The experimental results are given, and show a complete agreement with the computer simulation. Since PFM is free from low order harmonics, a simple low pass filter at the inverter output extracts nearly pure sinusoidal wave and the motor is driven very smoothly under different speeds form zero speed up to above the rated speed, by varying the reference wave frequency.

A THREE PHASE PFM INVERTER FEEDING AN INDUCTION MOTOR

ABSTRACT

A three phase pulse frequency modulation PFM inverter is designed and implemented to provide variable voltage variable frequency control for a three phase induction motor. The three phase PFM pattern is generated software-wise using a computer program fed to a PC. The modulating frequency and pulse width of the PFM pattern are selected after simulation investigations such that the low order harmonics are very small relative to the main harmonic and at same time avoiding overlapping and overmodulation and keeping the switching losses at reasonable level. Practical implementation shows a stable operation at low as well as at high frequencies with unpronounced low order harmonics.