Velocity Regulator of AC Motor with V/F Controller

[1]Mrs.D.Sangavi, [2]Mr.N.Rajagopal
[1]*PG Students, Dept of ECE,*
[1 2]*Vins Christian College of Engineering, Nagercoil, India*

Abstract

A novel VLSI speed control method for induction motors using V/f controller that contributes almost zero steady-state speed error at any frequency and highly efficient torque.The present paper recommended stands alone control equipment for manufacturingbeginning motor speed control.This method leads to be able to change the speed of the motor by control the frequency and amplitude of the stator voltage of induction motor, the ratio of stator voltage to frequency have to be kept constant, which is called scalar control of AC motor drive. The Variable-speed drives are created when a motor is combined with a power electronicsconverter. By introducing variable speediness to the driven load, it is potential for the optimization of effectiveness of the entire structure and outcomes in greatest good organization gains. The speed is Control in AC Motors. AC motor drives are used in control applications such as the speediness of move forwards speeds, transmit or systems,engine tool speeds, and others that require variable speed. The altered methods of controlling AC motors, Control has verified to be the most flexible and accurate method. In this, PWM Inverters have been modelled and their output is fed to the AC Motor drives.

Keywords*: ACMotor, Voltage/frequency (V/f), PWM, Random Weight Change.*

I. INTRODUCTION

AC Motors are low-cost compared to DC and Synchronous Motors. In this age of resentment, this is a majornecessity for any machine. Due to its nation of procurement, equipment and use, the AC motor is usually the first choice for an operation. AC Motors are extremely rugged in construction. There robustness enables them to be used in all kinds of environments and for long durations of time. AC Motors have high efficiency of energy conversion. Also they are very reliable. Due to their ease of construction, AC Motors contain low security costs and high efficiency. This property is useful in applications where the weight is usefulearlier thaninitial the motor. Anotherbenefit of the AC Motor over other motors is the ease with which its speed can be controlled. Speed control is a necessity in AC the subsequent factors of motors: It ensures smooth operation. It provides torque control and increase of speed control. Transformed processes require the motor to run at changed speeds. It compensates for variable process parameters. Throughout equipment, slow running of the motors is essential. All these factors present a burly case for the act of speed control or changeable speed drives in Induction Motors.

II. LITERATURE SURVEY

Burton B. and other suggested an artificial neural network (ANNs) can be ablefrequently on-line to identify an inverter-fed AC motor and controlling its stator currents [11]. The time to complete one instruction cycle is extremely small. In this work proposed and evaluated a new form of the Random Weight Change (RWC) algorithm, which is based on the method of random search for the error surface gradient. A VLSI process completes one training cycle in 8 µs. Da Zhang, Hui Li projected a particular FPGA to be relevant the field-oriented control of AC motor constrain based on stochastic theory and neural system algorithm [12]. A stochastic neural network structure is future for a feed forward neural network to approximate the feedback signals in an induction motor drive. A new stochastic PI speed controller is developed with anti-windup function to improve the speed control performance. By applying the stochastic theory and neural network structure, the proposed algorithms develop the mathematics operations of the FPGA, save digital resources, shorten the algorithms, and considerably reduce the cost and present design flexibility and extra defect tolerance for the system.

III. PROPOSED SYSTEM

A. AC Motor Drives

The constant V/F control method is the trendiest method of Scalar control [6]. If the ratio of voltage to frequency is kept stable, the instability remains constant. It maintains the air- gap fluctuation of AC Induction motor constant in charge to accomplish higher run-time efficiency. The torque-speed characteristics of the V/F control reveals that the starting current is low, the stable operating region of the motor is increased and the speed range of the motor becomes wider. One of the most advantages is soft start capability in which motors are ramped up to speed instead of being abruptly thrown on line. This useful attribute reduces perfunctorystress on the motor and leads to lower protection cost aswell as a longer motor life.

Fig.1 AC Inverters

B. V/F Controller

- A variable-frequency creates control technique in which the stator currents of a three-phase AC electric motor are recognized as two critical mechanisms that can be demonstrated with a vector.Field-oriented control (FOC) is also known as Vector control.

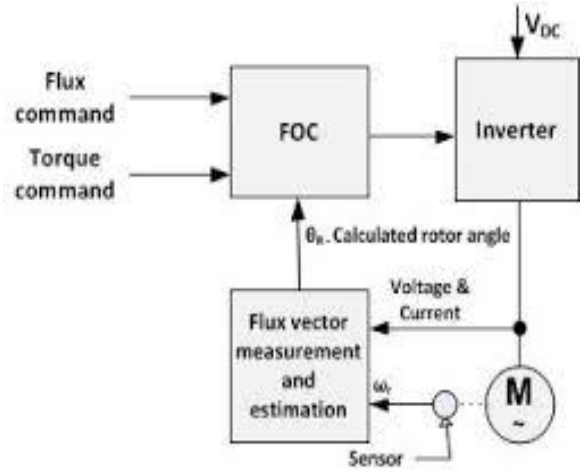

Fig.2 Block Diagram of V/F Controller

- VFDs are used in applications particular part from small appliances to the major of mine mill drives and compressors. variable-frequency drive (VFD) is a type of adjustable-speed drive used in electro-mechanical drive systems to control AC motor speed and torque by altering motor input frequency and voltage.

- Flux vector control

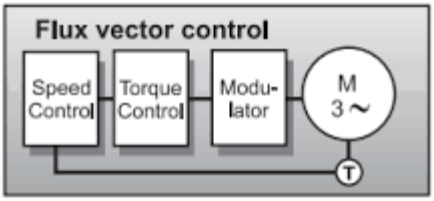

Fig.3 Block Diagram of Flux Vector Control

Flux vector control is another process of speed control and this attribute is also available on a number of model inverters which usually work below V/F control.

There are two methods of flux vector control:-

- Open Loop (sensor less vector).
- Closed loop (with encoder feedback).

Flux vector control principles:-

The torque affording and magnetising current vectors are separately controlled. Soit provided that accurate speed / torque control. This is enabled by motor the same circuit information of the motor. Motor parameters are entered in the oblige followed by an auto tune occupation. VSD then uses the auto tune data to manufacture a software model of the motor, for a narrowly matched speed / torque control.

C. Rectifier

A Rectifier is an electric device to converts Alternating Current (AC), which regularly reverses direction, to direct current (DC) that flows in only one direction. The process is known as rectification. Rectifier circuits perhaps will be single-phase or multi-phase. Usually low power rectifiers for conjugalmachinery are single-phase, but three-phase rectification is especiallysignificant for manufacturing applications and for the communication of energy as DC.

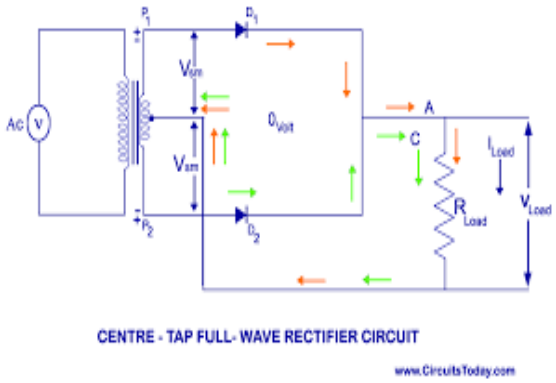

Fig 4 Full Wave Rectifier Circuit

D. PWM Inverter

An Inverter is a circuit which converts a DC power contribution into an AC power invention at a required output voltage and frequency. This redecoration is achieved by controlled turn-on and turn-off plans like IGBT's. Ideally, the output voltage of an Inverter should be strictly sinusoidal. However the outcomes are frequentlyprosperous in harmonics and are approximatelyforever non-sinusoidal. Square-wave and quasi-square-wave voltages are tolerable. The Power Circuit of the 3-Phase Inverter consists of 6 bidirectional IGBT's straight in bridge-form. The input to the circuit is a 12 V DC supply from a battery.

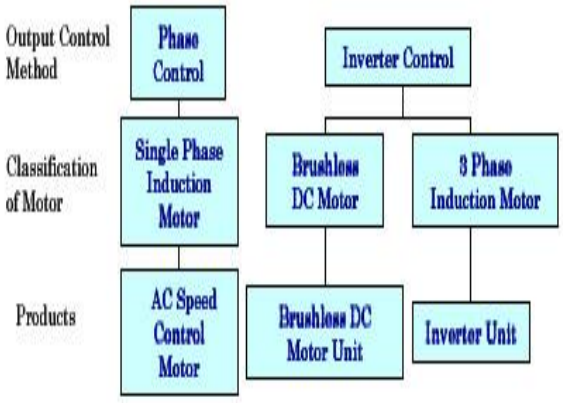

Fig5 PWM Inverter With V/F Controller

E. Gate Driver Circuit

A power amplifier accepts low-power participation from a controller IC and produces a high-current drive input for the gate of a high-power transistor such as an IGBT or authority MOSFET. While gate current is useful to a transistor to origin it to switch, a certainquantity of heat is generated which can, in some cases, be sufficient to devastate the transistor. Therefore, it is essential to keep the switching time as short as achievable, so as to diminish switching loss. To avoid this from occurrence, a gate driver is provided among the output signal and the power transistor.

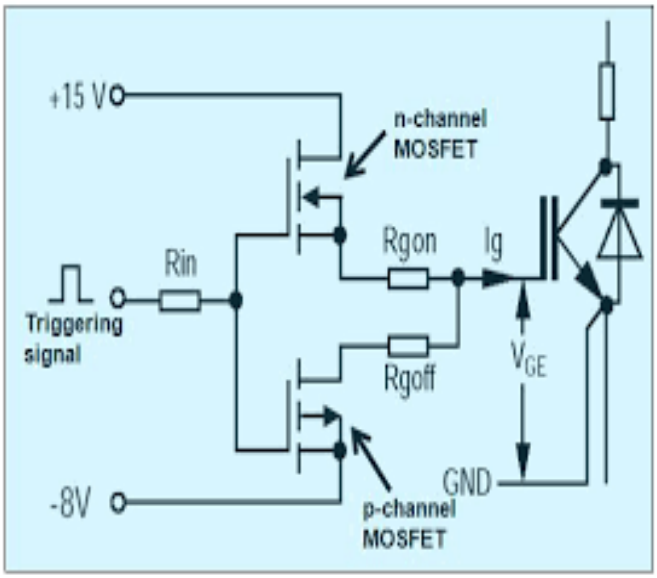

Fig 1.6 Block Diagram of Gate Driver Circuit

IV. ADVANTAGES OF V/F CONTROLLER MODEL

- Power electronics devices are smaller amountpowerexpenses devices as they work on a reduced quantity of voltage and reduced amount of current.
- Speed control of motor can be basically achieved by using these devices (MOSFET, IGBT) as there is no incidence of any heat dissipating device (resistor).
- Controlling circuit is extremelydense as estimate to the procedure used in the conventionalprocess and therefore they take fewer spaces.
- It is less expensive to control the speed since the electronic equipmentswhich enclose used are less expensive and easily obtainable.

V. SIMULATION MODEL OF V/F CONTROL METHOD

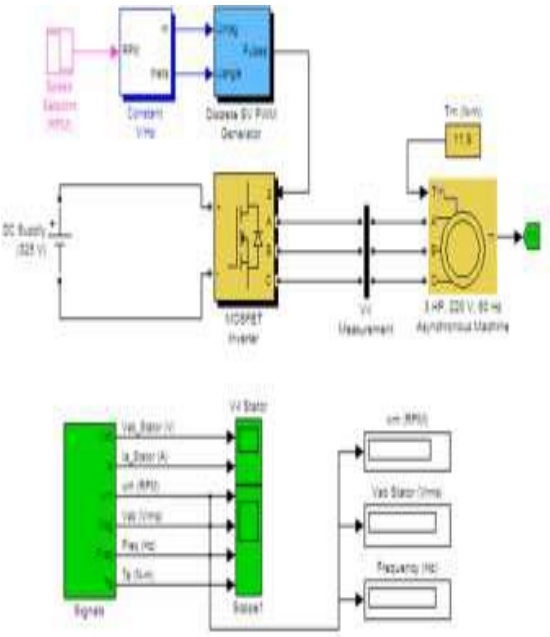

Fig 1.7 Matlab Simulation Model

Speed regulator of the motor is performed by the perpetualblock. The extent and frequency of theenergies are set based on the velocity set-point. By changing the voltages magnitude in proportion with incidence, the unrest is kept constant. The modulation inverter is built entirely with standard wedges. Its outcomegoes duringembarrassEnergySource blocks previous to being applied to the Asynchronous Machine block's windings.

For this imitation the velocity of a Motor is compared with orientation speed the mistake is given to the controller and limiter and the slip is further to incidence and this occurrence signal is multiplied by v/f and converted into voltage.This energy is given to block and there phase sin wave is compared by triangular wave. The incidencewaveform is also converted into theta angle and theta is given to block. This signal is used to operate the converter leg.Here IGBT switch is used.For controller tuning Method is used. To continue the air gap fluctuation as constant,ratio is maintained stable. The binary image is flaming and real time monitoring is potential of realized hardware. .

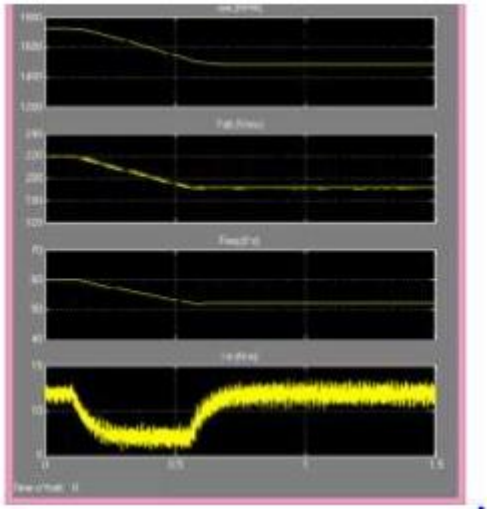

Fig 1.8 Schemes of Voltage, Frequency, Speed and Torque

VI. CONCLUSION

The Digital output pulses are generated using sine performance. The velocity control the motor is achieved using the converter group and wave generation is controlled using cRIO.The reference sine waveform amplitude and occurrenceis produced based on the logic for control system to maintain the flux as constant. Whenever the frequencyis altered to control the hustle of the motor, the outcomes energy is also inaccurate to prevent the spacecompletediffidence as conventional.We illuminated the control the speed of AC Motors with the help of Simulation. Finally this method is reliable and proficient with unsuitableharms.

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