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IM Speed Control above Base Speed using ANFIS and Field Weakening Controller

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Abstract - The field weakening based vector control of an induction motor has works under six step operations. The dc source is used to control the speed by vector control of an induction motor. This field weakening method can separate greatest conceivable torque without surpassing the machine voltage and current evaluations and can use the available dc link voltage completely. The primary intention of the work is to regulate current control regardless of whether the inverter output voltage is saturated i.e. it enters six-step method in mode of operation. Below base speed the drive will work as a typical rotor motion situated vector controlled drive. The inverter switch is controlled by a synchronous PWM system which is dynamic in both linear and over modulation zone. Thus, low switching frequency operation of the inverter is conceivable, for medium voltage application. The proposed induction motor based on six steps for regulating the speed is verified by using MATLAB/ Simulink.

I. INTRODUCTION

Control of electric engine in a wide field weakening section is imperative in traction application, where the drives work beneath base speed during beginning and low speed activity. Squirrel cage induction motor is a typical decision for traction because of its ruggedness [1-2]. In field weakening based induction motor, if the voltage reference is set at its most extreme value and the current drawn by the engine is constrained at its rated value, at that point greatest power can be drawn by it. Further, if the rated engine voltage matches with the inverter output voltage at its six stage method of operation, at that point, the usage of the inverter has increased [3-5]. Henceforth, the field weakening motor to likewise make the six step method of inverter operation. Field weakening motor greatest voltage accessible from the inverter is used to remunerate the back e.m.f, regulate the leakage impedance and reduce the resistance winding [6-7].

The current controllers are brought out of saturation by recognizing the voltage level utilizing zero vector time period and henceforth, the dynamic vector switching times are utilized to estimate the transition current reference [8]. Both the schemes empower performance on the hexagonal limit of the voltage space vector yet can't ensure six stage activities. An algebraic loop is formed in the voltage space vector by voltage detection technique. It utilizes integral controller rather than PI controller in voltage loop to keep away from algebraic loop. Look-up table strategy is another sort of voltage identification technique. Here flux current command and torque current references are computed by utilizing look-up tables [9-10].

II. PROPOSED METHOD

In field weakening region, when the inverter terminal voltage gets saturated and enters six stage method of activity, the q-axis current controller changes the flux current reference rather than straightforwardly producing the q-axis voltage reference. The purpose behind this is, at saturation condition, there is only a single level of opportunity, and i.e. either d-axis voltage or q-axis voltage can be controlled independently. Figure 1 shows the vector block diagram of proposed method.

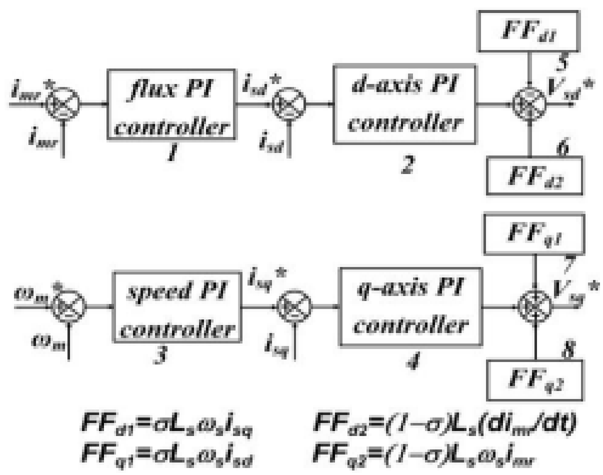

Fig 1: Vector Control of Proposed Circuit

The various PWM systems in field weakening and their exhibitions at six stage mode are not clear. DTC method makes the inverter to work in six stage mode amid field weakening circuit. This paper proposes a field weakening method for permanent magnet synchronous engine, where is compared with predetermined threshold for operation in field weakening method. Another proposes field weakening method where the flux current references are changed by voltage correlation. Beneath base speed, the drive works as an ordinary rotor transition situated vector controlled drive with rated flux current reference. These schemes are independent of motor parameters, as no motor designed is utilized to compute flux current reference.

III. SIMULATION RESULT

The overall simulation diagram is shown in fig 2. The dc link based on bridge circuit fed induction motor. The control circuit is shown in fig 3.

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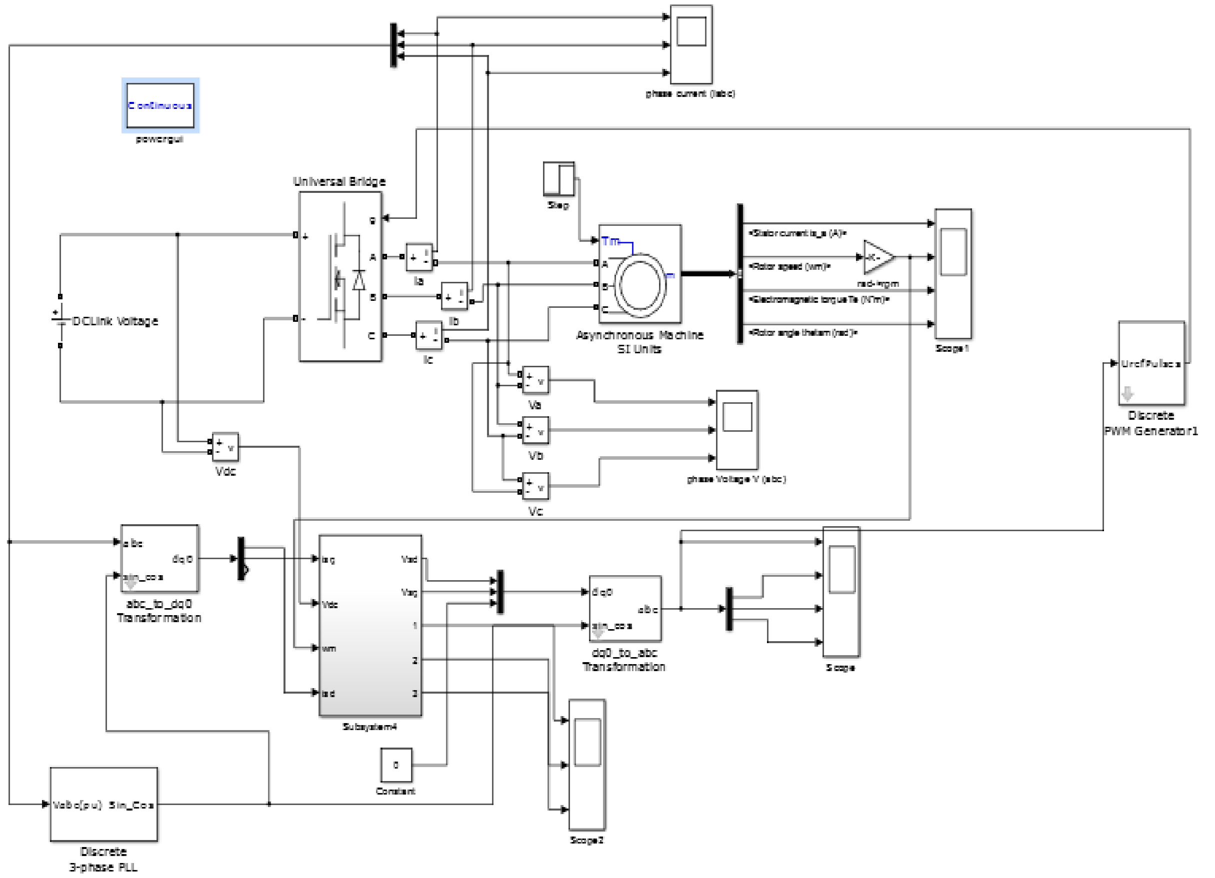

Fig 2: Overall Simulation Diagram of Proposed Circuit

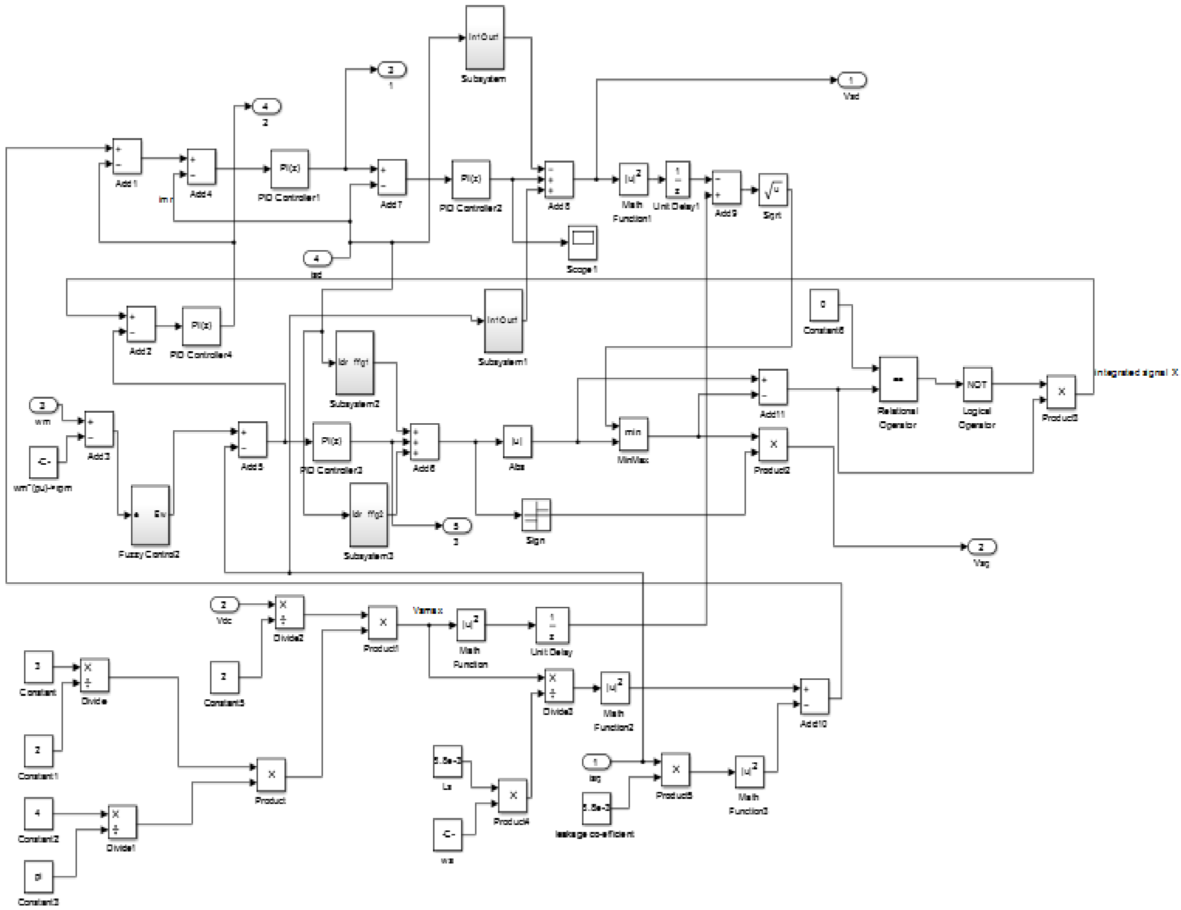

Fig 3: Control Diagram of Bridge Circuit

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The stator voltage of an induction motor is shown in fig 4. The speed and torque of an induction motor is shown in fig 5 and 6. The speed is regulated by using the field weakening control method.

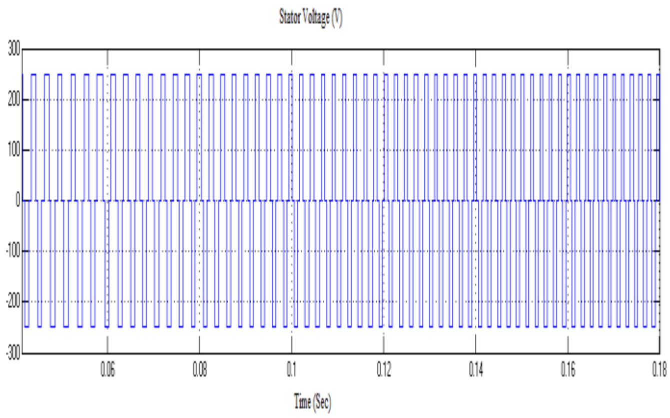

Fig 4: Stator Voltage of an Induction Motor

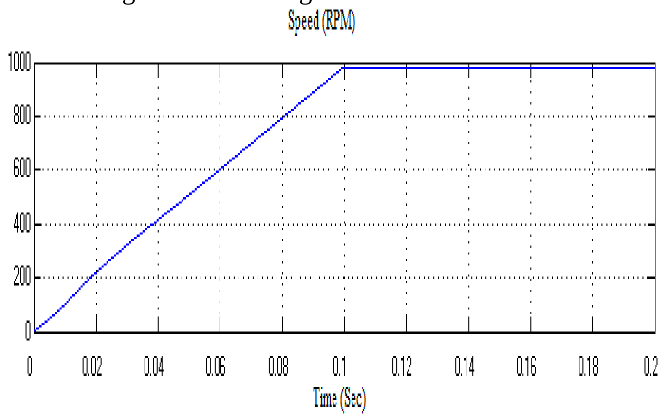

Fig 5: Speed of an Induction Motor

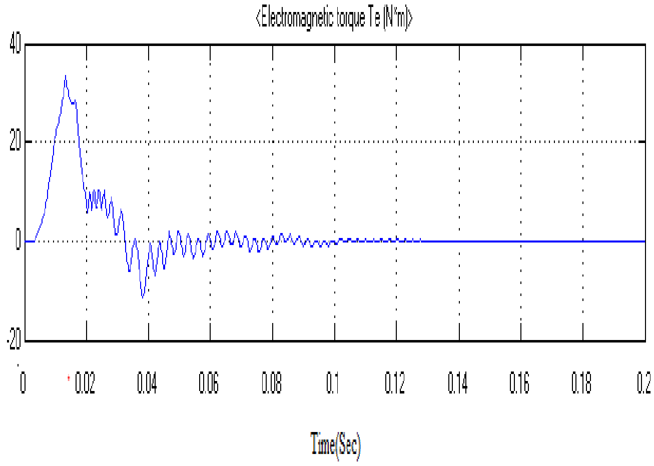

Fig 6: Torque control of an Induction Motor

IV. CONCLUSION

The field weakening control method based on induction motor has maintained the current and inverter is saturated to six step mode operation. The saturation of the inverter is detected the q axis current is calculated by the flux current control method. The sinusoidal pulse width modulation for minimum switching frequency and reduce the harmonic current at the output of motor. The speed and torque of an induction motor is regulated by using the field weakening concept.

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