Bell flexi Vybrshn Performance using Fuzzy Logic Controller to Determine the Speed of the Synchronous Machine

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Abstract

In this study, the flexi Bell Vybrshn using fuzzy logic controller to determine the speed of the synchronous machine is evaluated. Recently Azmntq fuzzy control applications has increased. The fuzzy controller based on the deviation of velocity vectors generated during different speed control. Alternating current electric motor winding, it is possible in different ways. The types of connections between the ropes or ropes are also possible. Select the appropriate method for winding an electric motor, sometimes simple and sometimes we need to review different. For example, in many cases, it is necessary to replace the windings of a motor burned before. The accuracy of the windings can get burned and Brdastn a simple map and details on the same winding repeated again and the diameter of the coil wire and then do the calculation. Digital simulation results show that the fuzzy speed controller designed has good dynamic behavior of the motor has good speed, without Overshoot and offers excellent behavior at impact loads disturbance. The results of fuzzy logic control for synchronous motor provides better performance than the conventional controller.

Keywords: flexi Vaybrshn Bell, a fuzzy logic controller, speed, synchronous machine

I. INTRODUCTION

The concept is to utilize the knowledge to build a practical controller is qualitative. For a process control system, a fuzzy control algorithm intuition and experience to be a designer and researcher at. The fuzzy control algorithm can be corrected by adjusting the fuzzy model and machine learning. Fuzzy control is inherently non-linear and consistent good performance under parameter variation and load disturbance effects show.

II. THE IMPORTANCE AND URGENCY OF THE ISSUE

An intelligent control technology, fuzzy logic control FLC it can be an adaptive control algorithm based on non-mathematical and linguistic process versus a conventional feedback control algorithms considered. Such application must be subject to translation to linguistic input variables like big positive, zero, negative small and using control rules so that the decision process can be output from produce the appropriate.

III. GOALS HAIR

The overall objectives :
Bell flexi Vaybrshn performance using fuzzy logic controller to determine the speed of the synchronous machine
Detailed objectives :
Synchronous motor drive

Voltage Inverter

Fuzzy logic control

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Vaybryshn flexi Bell and fuzzy logic controller

Methodology

It should be noted that in this study the effect of Psantshar algorithms and genetic algorithms and fuzzy logic to evaluate the efficacy, The present study makes it clear that the fuzzy logic propagation algorithm dydhast education departments the ability and accuracy of genetic algorithm is much higher. fuzzy control FLC Using the information and use of language has many advantages, such as $Roboustness$ General estimation rule, the law of freedom of the model and algorithm. Recent research has potential applications of fuzzy control to drive the car examined and it is shown that a fuzzy controller directly to the controller is designed to be integral, proportional, derivative surpass PID .[1]

IV. THE SYNCHRONOUS MOTOR DRIVE

Machine equations using a synchronous rotating frame, which is known as Park equations can describe the dynamic performance of a synchronous machine with more studied.[2] Dynamic model of synchronous motor in the frame can be shown by the following equations:

$$\begin{aligned} v_{ds} &= R_s i_{ds} + \frac{d}{dt}\varphi_{ds} - \varpi\varphi_{qs} \\ v_{qs} &= R_s i_{qs} + \frac{d}{dt}\varphi_{qs} + \varpi\varphi_{ds} \\ v_f &= R_f i_f + \frac{d}{dt}\varphi_f \end{aligned} \qquad (1)$$

Synchronous motor mechanical equation can be expressed as follows:

$$J\frac{d}{dt}\Omega = C_e - C_r - B\Omega \qquad (2)$$

in which the electromagnetic torque is shown in the frame.**[3]**

$$C_e = p(\varphi_{ds} i_{qs} - \varphi_{qs} i_{ds}) \qquad (3)$$

And the

$$\Omega = \frac{d}{dt}\theta, \theta = \int \Omega dt, \varpi = \frac{d}{dt}\theta_e = p\Omega, \theta_e = p\theta$$

Flux equations are as follows:

$$\begin{aligned} \varphi_{ds} &= L_{ds} i_{ds} + M_{fd} i_f, \\ \varphi_{qs} &= L_{qs} i_{qs}, \\ \varphi_f &= L_f i_f + M_{fd} i_{ds} \end{aligned} \qquad (4)$$

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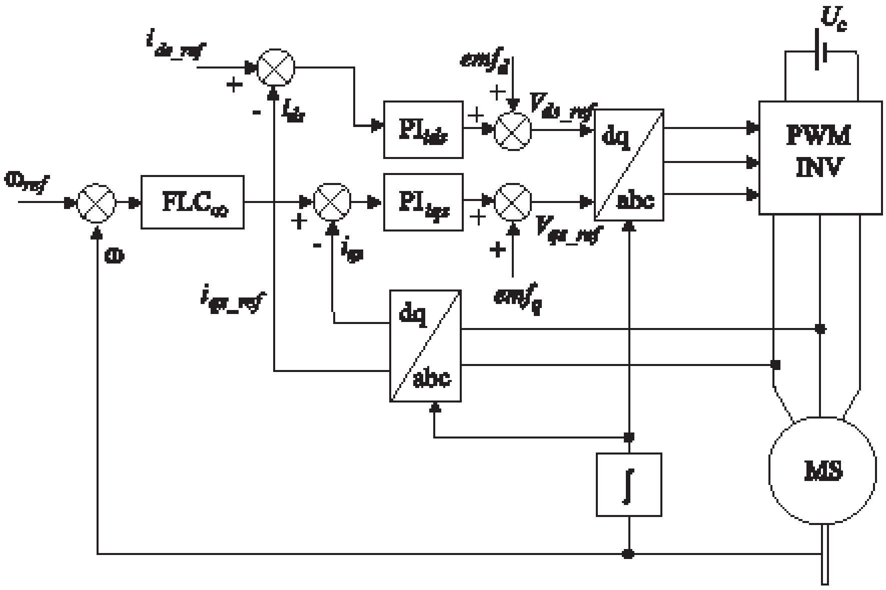

Figure 1: Structure of the control system of synchronous motor

That R_s Stator resistance, L_{ds}, L_{qs} Direct and cross stator inductance, L_f Hybrid field inductance, M_{fd} Mutual inductance between the armature coil, φ_{ds} & φ_{qs} Direct flux and width, respectively φ_f Field flux, C_e Electromagnetic torque and C_r External load disturbance, p The number of pole pairs, B Damping coefficient (Dmpyng) J Moment of inertia, ϖ Angular speed of the electric motor, Ω Mechanical angular velocity, θ Mechanical rotor position, θ_e The electrical rotor position. **[4]**

V. DESCRIPTION OF THE SYSTEM

An indirect method of measuring static flexibility range of motion is achieved using linear measurements. For this purpose you can use a ruler, tape and boxes sit and reach flexibility instead of inches or centimeters to measure motion. The main weakness is that some flexibility in length or width of field tests of various body parts May adversely affect the performance of motion, for example, a person with respect to the trunk, short legs, and sit for the tests at Brsnvy is superior. Some indirect tests for the assessment of movement and flexibility in your lower back is the vertebral column, including test and the modified sit and standard brushes (trunk flexion), shoulder lift test, test, test trunk and pulling the skin. [5]

American Association of Sports Medicine (ACSM) in 1995, trunk flexion test to measure flexibility of lower back and hip recommended.[6]

(Fingers can be put on both hands and then push forward, a moment they kept the same). Knees should be bent and students should refrain from bending over with one hand. The maximum distance (in cm) at which fingers are touching the box, the record is considered as subjects. [7]

That R_s Stator resistance, L_{ds}, L_{qs} Direct and cross stator inductance, L_f Hybrid field inductance, M_{fd} Mutual inductance between the armature coil, φ_{ds} & φ_{qs} Direct flux and width, respectively, φ_f Field flux, C_e Electromagnetic torque and C_r External load disturbance, p The number of pole pairs, B Damping coefficient (Dmpyng) J Moment of inertia ϖ Angular speed of the electric motor, Ω Mechanical angular velocity, θ Mechanical rotor position, θ_e The electrical rotor position.[8]

VI. VOLTAGE INVERTER

The schematic diagram of the speed control system is shown in Fig. Power circuit consists of a voltage source, which can be joined by a thyristor rectifier and an inverter thyristor three phase supply with its output connected to the stator synchronous machine.[9] Flow field synchronous machine which determines the field flux is controlled by the voltage. Synchronous machine parameters is given in the Appendix. Self-control operation of the inverter-fed synchronous machine in a rotor, control of torque and flux in the machine is right. The principle is the armature flux and field flux in an axis orthogonal or has been preserved.[10] Flux in the machine independently controlled by the field winding and the torque component of the armature current is affected.[11]

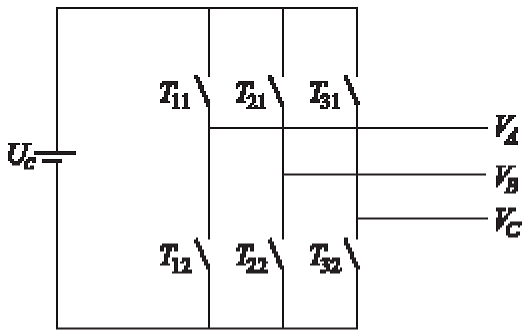

Figure 2: Voltage Inverters

In order to have optimal performance of the longitudinal i_{ds} Held equal. With the insertion, (4) and (3) $\lambda = pM_{fd} i_{qs}(t)$ Electromagnetic torque can be i_f Fixed $i_{ds} = 0$ Be written as follows:

$$C_e(t) = \lambda i_{qs}(t) \tag{5}$$

In the same condition it seems that the equations v_{ds} & v_{qs} are pairs.

Compensation for expressing the relationships we must analyze the system in use.[12]

$$\begin{aligned} emf_d &= \varpi L_{qs} i_{qs}, \\ emf_q &= -\varpi L_{ds} i_{ds} - \varpi M_{af} i_f \end{aligned} \tag{6}$$

The schematic diagram of the synchronous motor speed control using sliding mode control shows. Block $FLW_{\varpi}, PI_{id}, PI_{iq}$ The regulator. The first and second fuzzy controller speed regulator proportional, integral PI And third longitudinal flow regulator integrated, cross flow proportional PI_{iq} is.

To avoid the appearance of a block annoying saturation currents is used.[13]

VII. VOLTAGE INVERTER

A three-phase bridge inverter switching power circuit shown in Fig. The source is normally obtained through a voltage source through a rectifier and a filter used to achieve a constant voltage source can be achieved. Switching is assumed to be ideal. The simple inverter voltage can be demonstrated by logical function in matrix form.[14]

$$\begin{bmatrix} V_A \\ V_B \\ V_C \end{bmatrix} = \frac{1}{3} \begin{bmatrix} 2 & -1 & -1 \\ -1 & 2 & -1 \\ -1 & -1 & 2 \end{bmatrix} \begin{bmatrix} F_{11} \\ F_{21} \\ F_{31} \end{bmatrix} U_c \tag{7}$$

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Logical correlation function is defined as follows.
If the switch is closed when the switch is opened, if the voltage fed inverter.

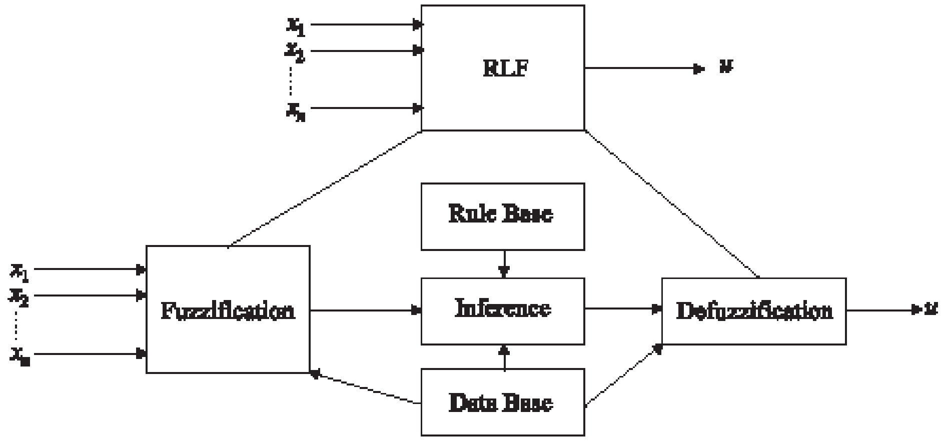

Figure 3: The structure of the fuzzy controller

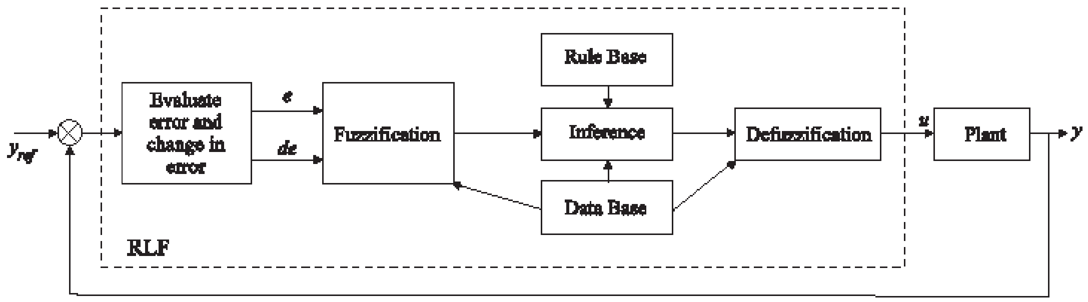

Figure 4: The structure of the fuzzy control system

VIII. FUZZY LOGIC CONTROL

structure of a fuzzy control system is comprised entirely of blocks below:
Fuzzy control, knowledge base, inference engine, Defuzzification
Figure 1 shows the structure of a fuzzy logic controller. The initial values of the input fuzzy control module to convert the fuzzy values. A fuzzy variable values that are defined by linguistic variables (fuzzy sets or subsets) Such as low, medium, high, large, slow, ... so that each defined by a member function with continuous changes. In terms of fuzzy sets, all possible values of a variable can be called to discuss the scope and fuzzy sets (membership functions are determined by the scope of the discussion to cover all. The fuzzy sets can be triangular, trapezoidal and so forth. A fuzzy control is essentially a human operator intuition and experience, and sometimes useful to designers and researchers. Database and the knowledge base rules to infer relationships R used shape. [15] Azmtghyyrhay descriptive database using input and output fuzzy sets. Basically the rule base system control strategy is usually obtained from the knowledge of experts and scholars, including a set of conditional expressions as a set of rules, IF_THEN Are expressed. [16]
As follows:

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$$R^{(i)} : x_1 \quad is \quad F_1 \quad and \quad x_2 \quad is \quad F_2 ...and \quad x_n \quad is \quad F_n$$
$$THEN, Y \quad is \quad G^{(i)}, \quad i = 1,...,M \tag{8}$$

Fuzzy logic principles:

That $(x_1, x_2,..., x_n)$ Variable input vectors Y Variable control. M number of rules n, the number of variables and fuzzy $(F_1, F_2,...F_n)$ fuzzy sets. A combination of the way in which such a control output can be generated using a rule base.Combination methods such as minimum - maximum, or sum - subtraction, maximum - point raised. Fuzzy values to the conventional mathematical process called defuzzification. [17] Number of defuzzification method is proposed. Select defuzzification methods usually depend on the application and processing power. This function can be performed by various methods among which are common height of center of gravity and methods.

IX. BELL FLEXI VIBRATION CONTROL AND FUZZY LOGIC

The general structure of a fuzzy control system is shown in Figure 4 is complete. Plant control u 2 state variable is inferred. Error e And changes in the Error Δe .
Details of the program are based on the fuzzy controller. fuzzy control rules are designed to set the control input u_{fuzzy} any combination of series e & Δe Rrefer.
Table 1 shows an example of a possible control rule base. Column represents the gradient of the error Δe and the rows represent the error e are.
Each pair $(e, \dot{e})$ output level NB than PB the corresponding u show. Here NB large negative, NM negative, ZR zero, PM positive average PB big positive in terms of fuzzy sets and membership functions corresponding to those in Fig. 5 and 6 and 7, respectively, are shown. Linkage of input membership functions, methods of reasoning and defuzzification methods for linkage mapping $u_{fuzzy}(e, \dot{e})$ is necessary. The triangular membership function, maximum -Mynymm reasoning method and centroid defuzzification is also frequently used in many other studies have been used. [18]

Table 1: Base Act for speed control

Du		DE$_n$				
		NB	NM	ZR	PM	PB
E$_n$	NB	NB	NB	NM	NM	ZR
	NM	NB	NM	NM	ZR	PM
	ZR	NM	NM	ZR	PM	PM
	PM	NM	ZR	PM	PM	GP
	PB	ZR	PM	PM	GP	GP

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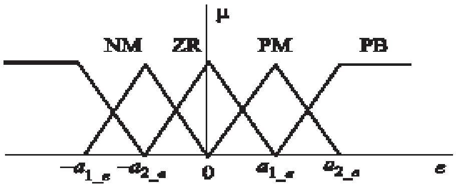

Fig. 5. Membership functions for input e

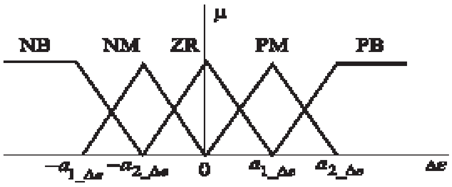

Fig. 6. Membership functions for input Δe

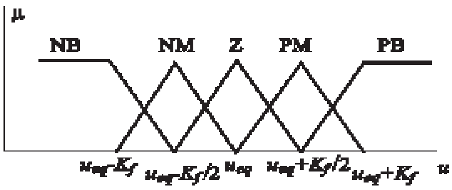

Fig. 7. Membership functions for output u

X. SIMULATION AND RESULTS

To validate control strategies as discussed above in Figure 1, the system of digital simulation studies have created. Velocity and current loops are designed to drive with fuzzy control and PI were simulated. Feedback control algorithms were repeated until the best simulation results were obtained. Closed loop speed control both flow and transient response PI and phase velocities tested. Start regardless of the simulation. The $\varpi_{ref} = \pm 100 \, {red}/{s}$ at $t_3 = 2s$ was reversed and time $C_r = 7Nm$ in the area $t_1 = 1$ & $t_2 = 1.5$ were applied to the system. Simulink simulation software was done in MATLAB environment. Figure 8 shows the performance of the fuzzy controller. The fuzzy controller has better performance to achieve the desired point. The fuzzy controller without any additional voltage load disturbance and the steady-state error is negligible disappear quickly. By a saturation function is ready to recognize the limits of its maximum torque flux preserved and kept in a reliable fashion. [19]

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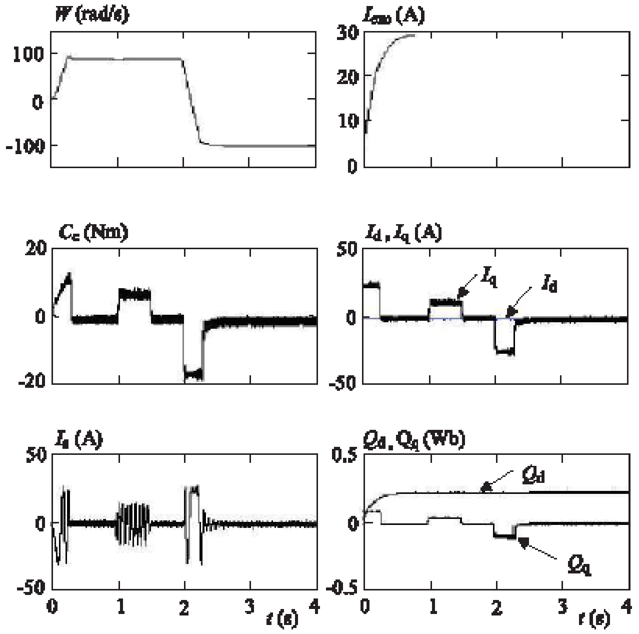

Figure 8: Results of the simulation speed control with fuzzy logic

we used method of speed control parameters uncertainties on the performance of In order to test the agreement.
Three cases are considered.

1. Moment of Inertia $(\pm 50\%)$
2. The rotor resistance Vastatvr $(\pm 50\%)$
3. rotor inductance Vastatvr $(+20\%)$

To demonstrate the performance of our control simulation once again entering the load and the and remove it $t_2 = 3$ have done. load $C_r = +7Nm$ in $t_1 = 2$
Considered in the presence of variable parameter Moment of Inertia, stator resistance, inductance of the step speed Astaatvr $+100\, rad/s$.

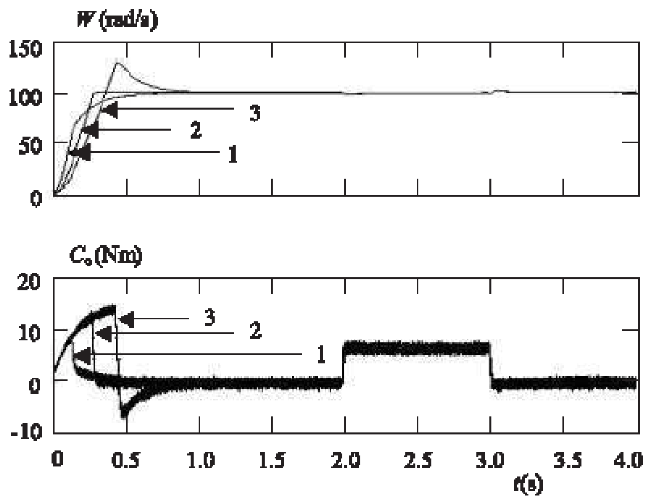

Figure 9

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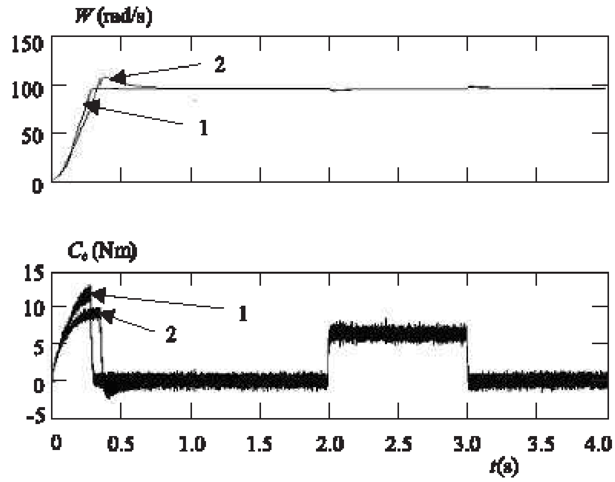

Figure 10

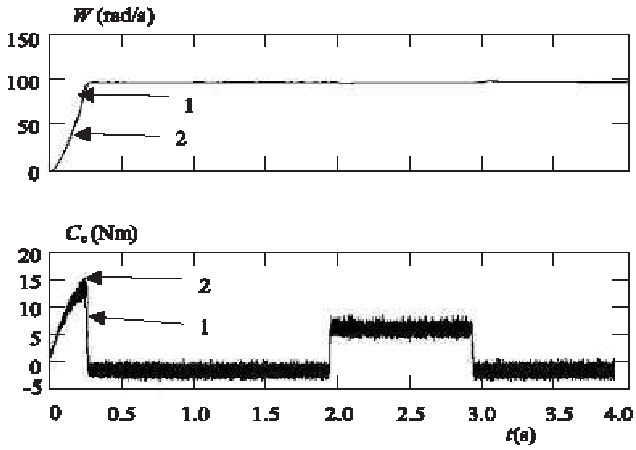

Figure 11

Figure 9 shows the fuzzy control *Robustness* tests with different values of the moment of inertia. Figure 10 shows the fuzzy control *Robustness* test for different values of the resistance. Figure 11 shows the test *Robustness* values Andvktany fuzzy control for rotor and stator. Barati control *Robustness* testing or increased moment of inertia, resistance or inductance technique has no impact on performance.

Increased moment of inertia gives us better performance, but it is a slow dynamic response. Our fuzzy controller to control a wide working space for the control parameters are unknown.

CONCLUSIONS AND RECOMMENDATIONS

In this study the consequences of a dirty bomb explosion, was evaluated. This paper presents a new approach to provide speed control for synchronous motor. This paper presents a simple controller to deal with uncertain parameters and external disturbances, work the system noise, the digital implementation and integral control. The control strategy based on fuzzy logic techniques. Stowe describes a fuzzy logic control system analysis and design of synchronous motor and system performance by simulation to validate the theoretical concept is studied. Simulation results show that the proposed robust controller is superior in accuracy and current samples. The simulation study clearly demonstrates the superior performance of fuzzy control, because it is inherently compatible. It is concluded that the presence of the response properties of a high performance parameters uncertain and load disturbances.

The logic used to control systems with uncertain model. Speed control by fuzzy logic low voltage fast dynamic response with steady-state error is negligible us. Analysis of stability of the equilibrium point Vhmgrayy also been investigated.

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Appendix

Three-phase synchronous motor parameters:

Nominal output power $3HP$

Nominal voltage phase $60V$

The nominal phase current $14A$

I rated voltage $v_f = 1.5V$

The name field $i_f = 30A$

Stator resistance $R_s = 0.325\Omega$

Field strength $R_f\, 0.05\Omega$

Longitudinal inductance of the stator $L_{ds} = 8.4mH$

Inductance of the stator section $L_{qs} 3.5mH$

I inductance link $L_f = 8.1mH$

Blaine armature inductance and mutual inductance $M_{fd} = 7.56mH$

Dmpyng coefficient $B = 0.005Nm/s$

Moment of Inertia $= 0.05kgm^2$

The number of pole pairs 2

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