ISSN- 2394-5125 VOL 06, ISSUE 07, 2019

# ANFIS Controller for Controlling Parameters of 3Phase Induction Motor

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***Abstract:***

For variable speed drive applications such as electric vehicles, 3 phase induction motor is used and is controlled by fuzzy logic controllers. For the steady functioning of the vehicle drive, it is essential to generate required torque and speed during starting, coasting, free running, braking and reverse operating regions.

This paper proposed the implementation of adaptive neuro fuzzy inference system i.e. ANFIS for controlling the various parameter of three phase induction motor. The various parameter of induction motor is flux, load, torque, terminal voltage, speed, rotor angle, stator currents, slip, id, iq, rotor currents v/s time this shows their performance characteristic on respective scope. The proposed neuro-fuzzy controller incorporates fuzzy logic algorithm with a five-layer artificial neural network (ANN) structure. The performance of the proposed neuro-fuzzy based vector-controlled induction motor drive is investigated at different operating conditions. In the designed ANFIS scheme, neural network techniques are used to select a proper rule base, which is achieved using the back propagation algorithm. This integrated approach improves the system performance, cost-effectiveness, efficiency, dynamism, reliability of the designed controller. Fuzzy based controller develops a control signal which yields on the firing of the rule base, which is written on the previous experiences & these rules are fired which is random in nature. This result shows, the outcome of the controller is also random & optimal results may not be obtained. Selection of the proper rule base depending upon the situation can be achieved by the use of an ANFIS controller, which becomes an integrated method of approach for the control purposes & yields excellent results, which is the highlight of this paper.

***Keywords****: Fuzzy Logic, Induction motor, MATLAB, Membership functions, Simulink Model ANFIS Fuzzy logic controller, Induction Motor.*

## I. INTRODUCTION

To control the input voltage to the three-phase induction motor three phase PWM techniques are used. Scalar speed control techniques such as voltage control, v/f control provide satisfactory performance for steady state conditions [1]. But under dynamic conditions such as starting, sudden change in the load and speed reversal, the performance deteriorates. To respond for such transient circumstances vector control methods are used [2]. In vector-controlled techniques using the suitable control algorithm, input voltage to the

ISSN- 2394-5125 VOL 06, ISSUE 07, 2019

motor is adjusted so that required amount of direct and quadrature axis currents are drawn by the motor to meet the requirements of desired speed and torque. Induction motors play a vital role in the industrial sector especially in the field of electric drives & control. Speed imbalances shows that, it is virtually impossible to achieve the desired task for a specific application. AC motors, particularly the squirrel-cage induction motors (SCIM), make an inherent gain like simplicity, reliability, low cost and nearly maintenance free electrical drives. Again, for high dynamic performance industrial applications, their control remains a challenging problem because they exhibit significant nonlinearities and many of the parameters, mostly the rotor resistance, vary with the operating conditions. The Field Orientation Control (FOC) of an induction machine achieves decoupled torque and flux dynamics leading to independent control of the torque and flux as for a separately excited DC motor. The FOC methods are attractive, but suffer from one major disadvantage, viz., they are sensitive to motor parametric variations such as the rotor time constant and an incorrect flux measurement or estimation at low speeds

## II. MATERIALS AND METHODOLOGY

In this section control strategy implemented in control of 3-phase induction motor drive is explained. Theoretical concepts used in implementation simulation model are focused. Simulink model for the control of many parameters of the induction motor can be developed in MATLAB. By using the knowledge window of MATLAB, it creates the .fis file and it will be helpful in the Simulink for controlling the speed of Induction Motor with an important role of ANFIS controller proposed in this paper. This Simulink model with the ANFIS controller can be developed using the various toolboxes available in the Simulink library such as the power system, power electronics, control system, signal processing toolboxes & from its basic functions. The entire system demonstrated in Simulink is a closed loop feedback control system consisting of the plants, controllers, samplers, comparators, feedback systems, constants, buses, the mux, de-mux, summers, adders, gain blocks, multipliers, constant blocks, CT & DT blocks, ANFIS editor blocks, clocks, sub-systems, integrators, state-space models, the output sinks (scopes), the input sources, work-space blocks, etc.

ISSN- 2394-5125 VOL 06, ISSUE 07, 2019

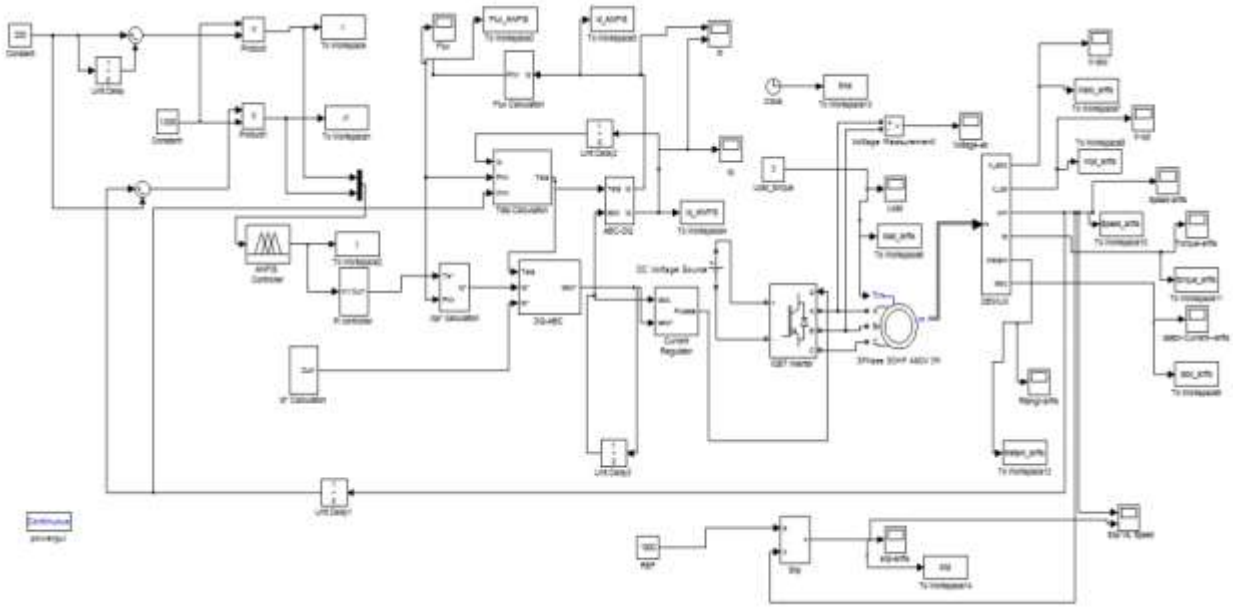

Figure (1) Simulink model for speed control of 3phase Induction Motor

## III. CONCLUSION

A systematic approach of achieving the speed control of an induction motor drive by means of adaptive neuro fuzzy inference control strategy has been proposed in this paper. Simulink model can developed in MATLAB with the ANFIS controller for the speed control of Induction Motor. The control strategy was also developed by writing a set of 49 fuzzy rules according to the ANFIS control strategy with the back propagation algorithm in the back end. The main advantage of designing the ANFIS coordination scheme is to control the speed of the Induction Motor & to increase the dynamic performance & to provide good stabilization. The characteristic curves of speed, torque, current, flux, slip, load, etc. vs. time we will observed. The outputs can take less time to stabilize, which can be observed from the simulation results. Due to the incorporation of the ANFIS controller in loop with the plant, it will observe that the motor reaches the rated speed very quickly in a lesser time compared to the Mamdani method.

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