Performance of Inverter Fed Induction Motor Drive Using Neuro Fuzzy Type-2 Controller

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G. Srinivas ; G. Durga Sukumar ; M Subbarao **All Authors**

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Abstract:
The conventional speed and current controllers perform well when the indirect vector control's working point is constant. The operating point, however, is always shifting. In a closed-system situation, the inverter's measured reference voltages show higher harmonics. As a result, the provided pulse is uneven and contains more harmonics, which enables the inverter to create an output voltage that is higher. A space vector modulation technique is presented in this paper for type-2 neuro fuzzy systems (NFT2). The inverter's performance is compared to that of a neuro-fuzzy type-1 (NFT1) system, a neuro-fuzzy type-2 system, and classical space vector modulation (SVM) using Matlab simulation and experim… …tor's performance metrics fo… … SVM. The performance… … of a Dspace-1104. The 2 H…

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Contents

I. Introduction

Space vector modulation is a technique for managing the PWM method used to regulate the inverter-fed induction motor. At the turning points, which are caused by space vector instants, the pulse width modulated voltage source inverter is used (VSI). In compared to the straightforward sinusoidal approach, switching times are reduced, and current and torque ripple are decreased [1]. For both linear and non-linear modes of operation, the digital implementation is a technique utilised in transient simulation. SVM is a method for implementing optimum bus voltage utilisation and support for the harmonic spectrum utilised in current applications [2]. To reduce ripple in torque and current, the ANFIS (adaptive neuro-fuzzy interference system) based MPPT is presented for induction motor driving in Matlab (Simulink) and is confirmed using an experimental setup utilising the hardware Dspace (1104) [3]. The type-2 fuzzy logic DTC (direct torque control) technique is implemented as a result of the replacement of proportional-integral controllers. Using the control technique, the reaction is improved in both transient and steady-state conditions. Under various operating conditions, it also reduces torque ripple and flux distortion in contrast to the regular DTC [4]. Instead of using filters to reduce torque ripple like standard PI controllers, adaptive NFIS current controllers are employed for an indirect vector of an inverter driven induction motor. The performance of the drive is simulated under various operating conditions. [5]. To reduce switching losses and output voltage distortion from the created SVM algorithm, the proposed method uses variable frequency modulation to VSI fed Induction motor [6]. Instead of a PI controller with no filter, a neuro-fuzzy torque controller is employed to eliminate torque ripple. The SVM approach is also suggested, although information is required to calculate the sector and angle[7]. For the error inside the boundary, an n-level VSI fed inverter with current error space vector hysteresis is used as the current controller. The advantage of the hysteresis controller is that it transitions from linear to over modulation smoothly. It has also been confirmed by experimental validation with steady and transient performances. [8]. For VSI fed IM drive, type-2 fuzzy-based methodology has been used. The technique has been compared to traditional SVM for performance and is independent of switching frequency. [9]. The ANFIS based SVM is not required to predict the switching frequency or required training error when using the SVM method. This is the reason why, in contrast to other optimization strategies like genetic, neural, and fuzzy [10]. The development of a technology known as constant switching frequency torque control can be used to manage torque in both steady-state and dynamic conditions. For calculating the torque ripple and angular velocity, it employs flux error vector-based SVM [11]. Fast switching frequency is implemented using the ANN SVM based SVM fed VSI, which leads to dynamic operation of the IM drive under linear region to square wave. [12]. SVM based on NFT2 and three-level inverter fed VSI are used to implement improved constant & dynamic performance of the IM drive. The suggested method generates an output with the proper duty ratios by changing the input space vector angle. The NN with a specific IC chip is used to easily implement the SVM algorithm. [13]-[14]. The recommended ANN with SVM-based VSI-fed IM drive estimates a variety of outputs without regard to switching frequency[15]. Three phase duty ratios are produced using a new sampling time independent technique with type-1 and type-2 fuzzy based techniques, and they are obtained without the usage of mathematical equations. But in type-1 & type-2 fuzzy based space vector PWM algorithms, the three phases duty ratios produced are sampling time independent and with a new integrated dead-time insertion in SVM itself [16].

Authors

Figures

References

Keywords

Metrics