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A novel neuro-fuzzy controller for vector controlled induction motor drive

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Abstract

In this paper, a novel neuro-fuzzy controller is proposed for the vector controlled induction motor. Neural network controller is interfaced with the three phase induction motor initially. Performance of this neural network controller with the three phase induction motor is analysed under disturbance environment. It is identified that neural network controller is not working well in terms of speed tracking. Hence neuro-fuzzy controller is interfaced with the three phase induction motor. Performance of this proposed neuro-fuzzy controller is analysed in the disturbance environment. At the end, Comparison chart is made to know the effectiveness of the proposed neuro-fuzzy controller with the neural network controller. This comparison chart is described for the various control system parameter aspects. It is recognised that the proposed neuro-fuzzy controller works well in the presence of the disturbances. Moreover, this neuro-fuzzy controller operates skilfully for all the necessary working conditions.

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Keywords: Neuro-fuzzy controller, neural network controller, Membership function.

1. Introduction

Three phase induction motor plays a vital role in industries because most of the process in industry need variable speed operation with 415V ac supply. Moreover, performance of the three phase induction motor under various speeds is a problem when an inappropriate controller is connected. Particularly in the disturbance environment conventional controller is not suitable for controlling the three phase induction motor. Therefore, this study aims to propose a robust controller for the three phase induction motor. In order to identify the robust controller for the three

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phase induction motor initially three phase induction motor is controlled by neural network controller under disturbance environment such as voltage sag and voltage swell. Performance of the neural network controller is analyzed in terms of settling time, steady state error. Then three phase induction motor is controlled by neuro fuzzy controller under disturbance environment such as voltage sag and voltage swell. Performance of the neuro fuzzy controller is analyzed in terms of settling time, steady state error. Moreover, the speed control action delivered by neural network and neuro fuzzy controller is compared interms of control system parameters.

Nomenclature	
V _{s_q}	stator voltage in q-axis
V _{s_d}	stator voltage in d-axis
NN	Neural network

2. Methodology

2.1. Neural network controller for the three phase induction motor

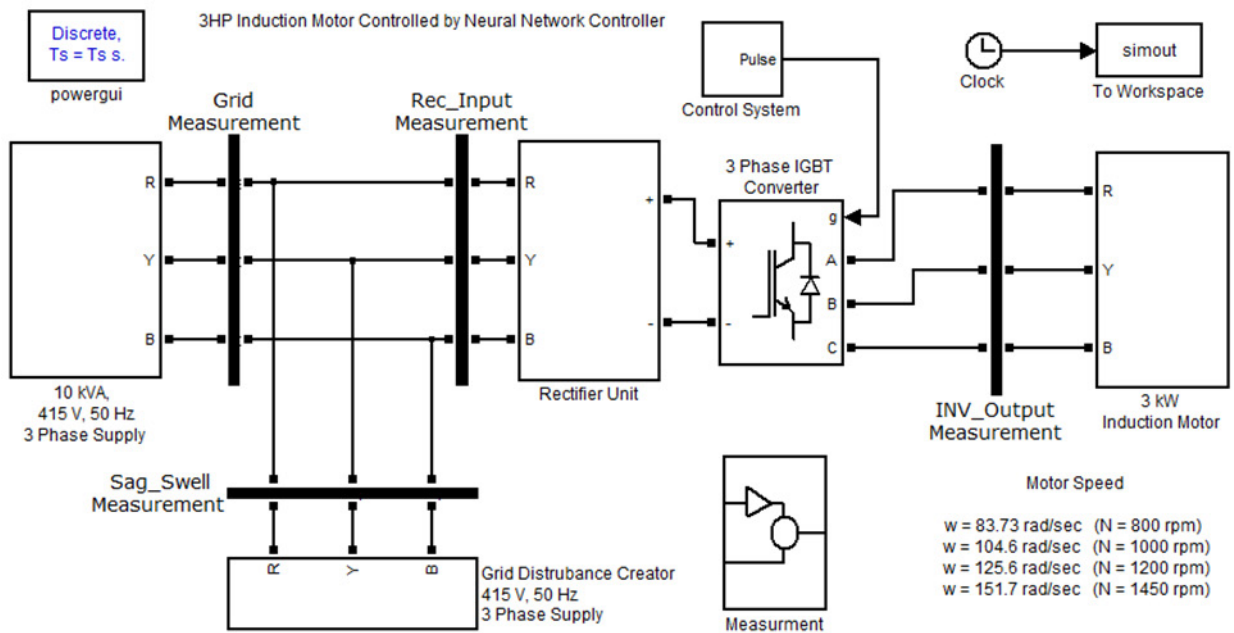


Fig (a) Block diagram of neural network controller for the three phase induction motor

Neural network controller for the three phase induction motor is shown in fig (a). Grid disturbance creator is involved in this block diagram for giving disturbance signal between 415V ac source and the rectifier. Voltage sag disturbance signal is formed with the help of inductive load. Voltage swell disturbance signal is formed with the help of capacitive load which is used in the disturbance creator. Then rectified dc signal is converted as ac signal along with the help of pulses (sinusoidal pulse width modulation). Moreover, ac voltage from the inverter is fed to the three phase induction motor.

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