NEURO FUZZY NETWORK (NFN) – BASED SPEED ESTIMATORS FOR DC MOTOR

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ABSTRACT

This report describes the design of Neurofuzzy based speed estimator for separately excited DC motor using MATLAB/Toolbox. A comparative analysis of the DC motor drive's behavior with and without Neurofuzzy based was performed. It is shown that Neurofuzzy is a good estimator to estimate speed and enables very good quality of the drive performance over a wide range operating conditions for both open and close loop systems.

For the purpose of the training, ANFIS (Adaptive-Network-based Fuzzy Inference System) was used because the problem only can be tackled by using differentiable functions in the inference system. ANFIS uses back-propagation learning to determine premise parameters (to learn the parameters related to membership functions) and least mean square estimation to determine the consequent parameters. General rule is to obtain the best performance of Neurofuzzy DC motor speed estimators with minimum training parameters. From the results obtained, it shows that Neurofuzzy is alternative controller to replace the classical method.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Nowadays, intelligent systems including fuzzy logic systems, neural network and genetic algorithm, have been successfully used in widely various applications. Neurofuzzy systems combine the advantage of fuzzy logic systems and neural networks have become a very active subject in many scientific and engineering areas, such as, model reference control problems, PID controller tuning, signal processing, etc. Neurofuzzy has the properties of parallel computation scheme, easy to implement, fuzzy logic inference system, and parameters convergence. NFN (Neuro Fuzzy Network) is a fuzzy system that uses a learning algorithm derived from or inspired by neural network theory to determine its parameters (fuzzy sets and fuzzy rules) by processing data samples. It is a popular framework for solving complex problems. Learning is assumed to reduced design costs, increase flexibility, improve performance and decrease human intervention. One of the applications that use NFN is the design of speed estimator for DC drive.

The development of speed sensorless, high-dynamic performance DC motor is currently attracting considerable interest due to the reliability increase and cost reduction, which can result from the elimination of speed transducer. Performance of speed estimators used in DC motor is classified as being of 'conventional' or 'artificial-intelligent-based' (AIB) types. Conventional approaches to the estimation of the system states are generally model-based, estimator-based or observer-based and the main techniques for development of speed-sensorless drives are estimators using monitored motor quantities or saliency effects. Estimates of both the DC motor speed and fluxes may be required for control purposes.