DESIGN OF ARTIFICIAL NEURAL NETWORK (ANN) BASED ROTOR SPEED ESTIMATOR FOR DC DRIVES

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In the name of Allah

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ABSTRACT

This report describes the design of ANN based rotor speed estimator for separately excited DC motor. The design is created using the MATLAB Toolbox. A comparative analysis of a DC motor drive behavior with and without ANN based was performed. It is shown that rotor speed feedback by a suitably trained ANN enables very good quality of the drive performance over a wide range (open loop and close loop system) operating conditions. The variable input data of armature voltage and armature current and the output rotor speed data was collected by using training data obtained by simulation of the drive system. For this purpose the Levenberg-Marquardt back-propagation algorithm was used. The training took only a few minutes on a PC and for this purpose 30000 input-output training data were used. A standard three layer feed-forward neural network with tan-sigmoid (tansig) activation functions in the hidden layer and purelin at the output layer is used for this work. The result shows that by using only one hidden layer, minimum error can be obtained as what is needed and also excellent in performance. It is satisfied that, even the application of ANN rotor speed feedback in closed loop system, the speed obtained is variable speed. This was tested by training the NN using minimum hidden nodes until reach an optimum results between open loop and close loop system. The NN speed estimator provides an accurate speed information in either different operations from those that have been trained or in parameters variation cases. The proposed solutions seem to be attractive to the traditional speed estimator, resulting in a mechanically simpler motor and consequently increasing the degree of reliability for the whole drive systems.

TABLE OF CONTENTS