NEURAL PREDICTIVE CONTROL FOR A THREE-PHASE POWER CONVERTER SVPWM WITH CURRENT REGULATOR

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ABSTRACT
This paper presents the application of predictive control technique using artificial neural networks for a three-phase power converter space vector PWM with current regulator. Predictive control is an algorithm to minimize the performance index of prediction model of the power converter to generate control action. The model of three-phase power converter which is used to predict the future values, is based on artificial neural network. The simulation results of the proposed method are shown by using Matlab Simulink.

KEY WORDS
Predictive Control, Power Converter, Current Regulator, Neural Networks

1. Introduction
Many three-phase rectifiers with a diode bridge rectifier circuit and capacitor on dc side are used in industrial applications. These rectifiers are very simple and low in cost. However, these rectifiers perform only unidirectional power flow and are characterized poor power factor and high harmonic line currents [1]. Therefore, a three-phase power converter space vector PWM gives a good solution for industrial application. The advantages of three-phase converters are bidirectional power flow, sinusoidal line current, possible to regulate the power factor of input line, and to stabilize the dc link voltage [1-2], [8-9], [10]. To perform a unity power factor of line current and good performance of dc link voltage of a three-phase power converter, control design is required. Proportional and Integral (PI) controllers have been used to solve the problem [3]. However, it is difficult to optimise the performance of the plant. Another approach is based on the predictive control. With this strategy, plant model to predict future behaviour of plant, and an optimization algorithm is required.

As known that neural networks have been applied very successfully in the identification and control of dynamic systems [4]. Multilayer perceptron is the most popular neural network that used to be applied as a universal approximator for modelling of nonlinear systems and controllers.

Figure 1. Three-Phase Power Converter SVPWM with Current Regulator

In this paper, it is proposed to use neural predictive control for three-phase power converter with current regulator. With this method, a neural network model is used by controller to predict the future dc voltage of converter response, so that the line currents can be controlled. An optimization algorithm computes the control signal to optimize the future plant performance. The neural network plant model is a time delayed neural network (TDNN) and trained offline.

Figure 2. Neural Predictive Control of Three-Phase Converter SVPWM with Current Regulator