Design and Implementation of a Voltage Tracking with Artificial Neural Network Controller for a Double-input Buck-Boost Converter

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***Abstract*—This paper proposes an Artificial Neural Network (ANN) control voltage tracking scheme of a double-input buck-boost DC-DC converter. In this topology, a back-propagation algorithm topology is implemented. The controller is developed to improve the performance of the double-input converter during transient and steady-state operations. The neural network controller design, which is developed against output voltage command tracking is proposed. The proposed concept has been investigated and validated experimentally on a laboratory prototype using DSP TMS320F28335real time digital controller to verify the dynamic response of the proposed controller. The experimental results confirm the validity of the proposed neural network control technique, which is a promising an efficient control topology that ensures double-input converter suitable for electric vehicle and renewable energy applications.**

***Index Terms*— Artificial Neural Network Controller; Double-Input Buck-Boost Converter; Voltage Tracking.**

I. INTRODUCTION

These days, double-input direct current (DC) power supplies are extensively used in many applications comparisons to single input power electronic devices such as electric vehicle and the green energy applications [1].

Consequently, the DC-DC double-input converter is used by converting a DC voltage which generated from different input voltage sources to a different DC voltage level to provide the DC output voltage level requirements of the load [12]. Additionally, the DC-DC double-input converter is also a substantial application for the power conditioning of the alternative electrical energy such as photovoltaic, wind generator and fuel cell system. For these reasons, the DC-DC double-input converter applications will lead to a more possibility potential market in green energy applications [2].

Essentially, the double-input converter consists of the power semiconductor devices which are operated as electronic switches circuits to convert the electrical energy from different electrical energy supplies. Implementation of the power switching devices causes the inherently nonlinear characteristic of the double-input converters. Due to this unfavorable nonlinear characteristic, the double-input converters require a control unit with a high performance of dynamic response [3].

To solve this problem and develop the dynamic response of double-input converters, various intelligent control techniques such as fuzzy logic and neural network methods for double-input converters have been reported in [4]- [11].

A. Double-Input Buck-Boost Converter

The circuit outline of the proposed double-input buck-boost converter as shown in Figure 1. It had been intentionally assumed that switch 1, switch 2, switch 3 and switch 4 indicated as S1, S2, S3 and S4 respectively while diode 1, diode 2, diode 3 and diode 4 indicated as D1, D2, D3 and D4 respectively. A circuit outline of the proposed double-input buck-boost DC-DC converter is depicted in Figure 1.

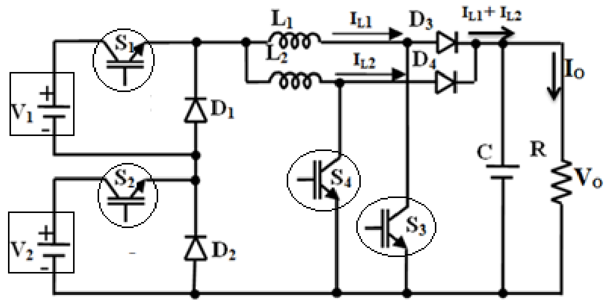

Figure 1: Circuit outline of the double-input buck-boost DC-DC Converter.

B. Voltage Transfer Ratio of The Proposed Double-input Buck-Boost Converter

Switching pattern of switches S1, S2, S3 and S4 are shown in Figure 2. The pattern is valid for all the possible arrangements of the proposed converter as it is composed of all the four operation modes.

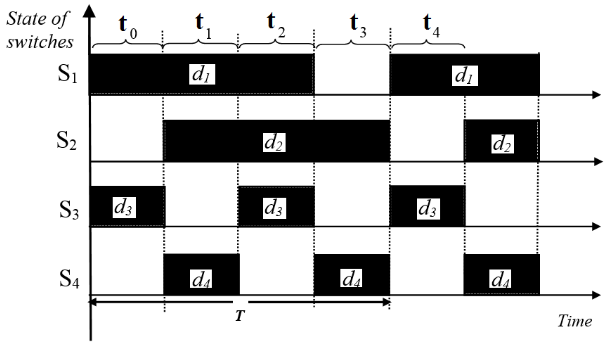

Figure 2: Switching pattern signals and duty cycle of switches.