Voltage Tracking of a Multi-Input Interleaved Buck-Boost DC-DC Converter Using Artificial Neural Network Control

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***Abstract*—This paper proposes an artificial neural network (ANN) voltage tracking of multi-input interleaved buck-boost DC-DC converter. A back-propagation algorithm topology is implemented in this paper. The control unit is implemented to ameliorate the performance of the proposed multi-input converter during transient dynamic response and steady-state operation mode. The neural network controller unit design, which is adaptive against output voltage command tracking and reference voltage variations is proposed. The proposed design has been verified through the MATLAB software. The simulation outcomes emphasized the validity and reliability of the proposed neural network technique, which would be a promising an efficient control method that ensures multi-input converter suitable for electric vehicle and renewable energy application systems**

***Index Terms*—Multi-Input Converter; Algorithm Back-Propagation; Artificial Neural Network Control; Tracking Voltage Variations.**

I. INTRODUCTION

These days, multi-input DC control supplies are broadly utilized as a part of many advanced applications in comparison to the single port electronic system, for example, electric vehicle and furthermore the sustainable power source applications [1].

Thus, DC-DC multi-input converter is broadly utilized by change over a DC voltage created from various input voltage supplies to an alternate direct voltage amount to supply the direct voltage source amount demand of the electrical load.

Furthermore, the multi-input converter is likewise an imperative application for the power control of the renewable energy system, for example, solar panel and wind turbine. Because of these reasons, multi-input converter applications will go to a more potential market in sustainable power source applications [2].

Fundamentally, the multi-input converter comprises of the power semiconductor system which worked as an electrical converter with a specific end goal to transform the electrical energy from various power supplies. The operation processes of the switching system cause the innately nonlinear normal for the multi-input converters. Because of this undesirable nonlinear characteristic, the multi-input converters require a controller system with an excellent level of dynamic reaction [3].

With a specific end goal to handle this issue and enhance the dynamic reaction of multi-input DC-DC converters, a few knowledge controller procedures, for example, fuzzy logic controller and neural network control techniques for DC converter have been described for in [4]-[11].

II. MULTI-INPUT INTERLEAVED BUCK-BOOST CONVERTER

The circuit outline of the proposed multi-input interleaved buck-boost converter as described in Figure 1. It had been intentionally supposed that Switch$_{(1)}$, Switch$_{(2)}$, Switch$_{(3)}$ and Switch$_{(4)}$ signified as $S_{(1)}$, $S_{(2)}$, $S_{(3)}$ and $S_{(4)}$ separately while Diode $_{(1)}$, Diode $_{(2)}$, Diode $_{(3)}$ and Diode $_{(4)}$ indicated as $D_{(1)}$, $D_{(2)}$, $D_{(3)}$ and $D_{(4)}$ individually. The gate pulses of the switches for the proposed converter have been purposely assumed that the duty cycle of $S_{(1)}$, $S_{(2)}$, $S_{(3)}$ and $S_{(4)}$ described as $d_{(1)}$, $d_{(2)}$, $d_{(3)}$, and $d_{(4)}$ respectively. A circuit diagram of the proposed multi-input interleaved buck-boost DC-DC converter designed is shown in Figure 1. Switching pulses pattern of switches S_1, S_2, S_3 and S_4 are described in Figure 2.

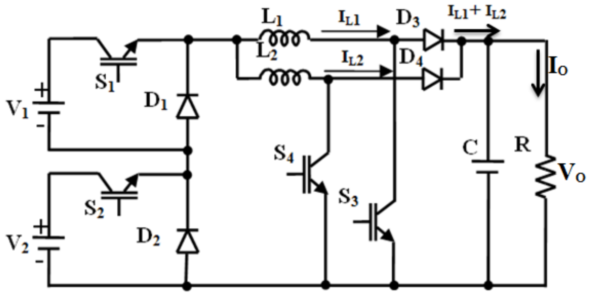

Figure 1: Circuit diagram of the Multi-Input Interleaved buck-boost DC-DC Converter

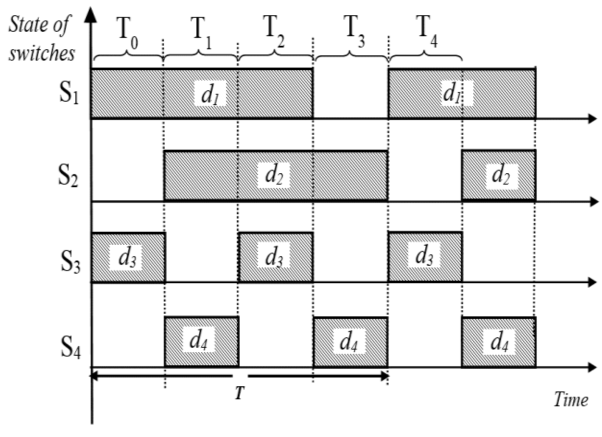

Figure 2: Switching pattern and duty cycles of switches $S_{(1)}$, $S_{(2)}$, $S_{(3)}$ and $S_{(4)}$