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DSP BASED BUCK CONVERTER FOR SOLAR APPLICATION

ABSTRACT

As people are much concerned with the fossil fuel exhaustion and the environmental problems caused by the conventional power generation, renewable energy sources and among them solar panels and wind-generators are now widely used. Photovoltaic as solar sources are used today in many applications such as battery charging, water pumping, home power supply, swimming-pool heating systems, satellite power systems etc. They have the advantage of being maintenance and pollution-free but their installation cost is high and, in most applications; they require a power conditioner (dc-dc or dc-ac converter) for load interface. Since PV modules still have relatively low conversion efficiency, the overall system cost can be reduced using high efficiency power conditioners which, in addition, are designed to extract the maximum possible power from the PV module.

INTRODUCTION

Input voltage control of dc-dc converters is often required in photovoltaic (PV) applications. In this special situation, unlike conventional converters, the output voltage is constant and the input voltage is variable. Conventional converter models generally found in the literature are not applicable to this situation. Converters with input voltage control are seldom studied and this research aims to clarify this subject. Therefore the scope of this research surround in the control system of the input voltage of the dc-dc converter fed by a PV array.

The outcomes of this research would probably give a significant contribution in increasing the efficiency of the PV system and hopefully can spur our country towards green technology. This area of research study is expected to contribute primarily in the field of electrical engineering especially in the field of power electronics and renewable energy systems. The proposed system can be further enhanced for a hybrid system where the MPPT control more than one renewable energy source. Furthermore, it can be coupled with an uninterruptible power supply system in commercial buildings or it can be used to supply power to the electrical grid through a dc-ac converter.

PRODUCT SPECIFICATION

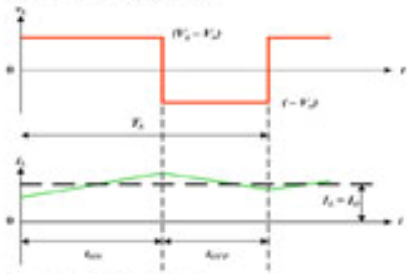
Input voltage: **24 Vdc**
Buck converter output voltage: **12 Vdc**
Maximum output power: **60 W**
Duty cycle: **50%**
Switching frequency: **50 kHz**

Basic Circuit

Buck converter with variable input voltage fed by a photovoltaic (PV) array.

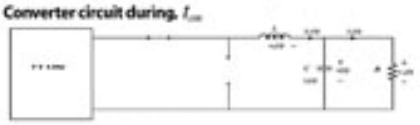
$$V_o = V_g D$$

Continuous Conduction Mode



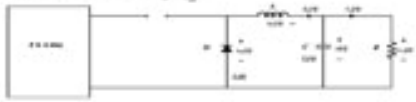
$$\frac{\Delta V_o}{V_g} = \frac{1-D}{8LCf^2}$$

Converter circuit during, t_{on}



$$L_{min} = \frac{(1-D)R}{2f}$$

Converter circuit during, t_{off}



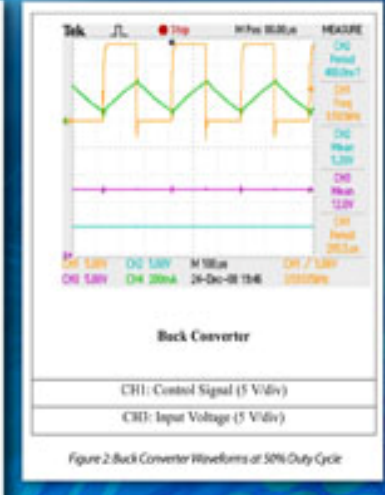


Figure 2: Buck Converter Waveforms at 50% Duty Cycle

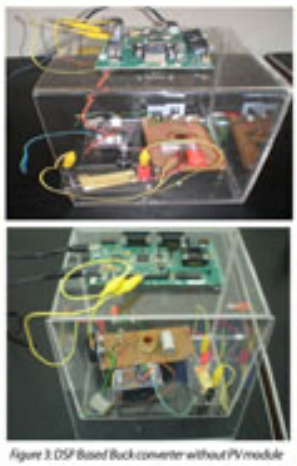


Figure 3: DSP Based Buck converter without PV module

NOVELTY

Digital based signal processing control systems, Maximum Power Point Tracking (MPPT) algorithm.

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