International Journal of Computing Algorithm
Volume: 05, Issue: 02, December 2016, Page No.88-90
ISSN: 2278-2397

Renewable Energy Based on Current Fed Switched Inverter for Smart Grid Application

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Abstract - Renewable energy is used in the current fed switched inverter for high power production. High voltage support, wide yield ranges of operation, shoot-through resistance are a portion of the desired properties of an inverter for a reliable, versatile and less ripple AC inversion. This paper proposes a single stage, high boost inverter with buck-boost capacity which has a few particular advantages over traditional voltage source inverters (VSI) like better EMI noise, wide input and output voltage range of operation, and so on. The proposed inverter is named as Current-Fed Switched Inverter (CFSI). A renewable energy based converter structure of CFSI has been created which supplies both AC and DC loads, at the same time, from a single DC supply which makes it reasonable for DC smart grid application. This paper proposes the operation and control of a CFSI based converter which directs the AC and DC conversion voltages at their reference. The advancement of the proposed converter from essential current fed DC/DC topology is explained. The closed loop controller is verified by using the MATLAB/ Simulink environment.

Keywords: Current fed switched Inverter (CFSI), EMI (Electromagnetic noise), and Grid.

I. INTRODUCTION

In recent days voltage source inverters (VSIs) are as a rule broadly utilized as a part of businesses because of its different focal points. Uninterruptible power supplies, sunlight based photovoltaic (PV) and energy unit applications, wind control frameworks, half breed electric vehicles, mechanical engine drives, and so on are the fundamental uses of voltage source inverters [1-2]. Be that as it may, now buck operation is conceivable with the conventional VSI. As the voltage level of the PV board is low (normally 40-50V), high help reversal is in the little housetop sun based PV/energy component applications. Either a two-arrange help inverter structure or a venture up transformer can be utilized for this reason. In any case, when cost, size, and productivity of the inverter framework is considered, it's better to utilize transformer less change topologies [3-4]. To accomplish the most extreme pick up, regular lift converter is to be worked at obligation proportion (D) close solidarity. Yet, the high current with little heartbeat width must be endured by the diode and yield capacitor. These outcomes in serious turn around recuperation of the diode, which builds the conduction misfortune and produces electromagnetic impedance (EMI). This issue is exasperated at high exchanging frequencies as the invert recuperation time (trr) of the gadget might be bigger than the time accessible amid (1-D) interim [5-6]. In addition, greatest yield to enter voltage change proportion of a boost converter is around 4–5. Whenever a VSI takes after a high-pick up dc-dc help topology, which is known as a two-organize change. The yield of the dc-dc arranges is voltage-solid. EMI is the significant issue related with a two-arrange dc-air conditioning reversal. EMI may cause breakdown of the inverter and harm of the inverter switches [7-8]. The block diagram of proposed inverter is shown in fig 1.

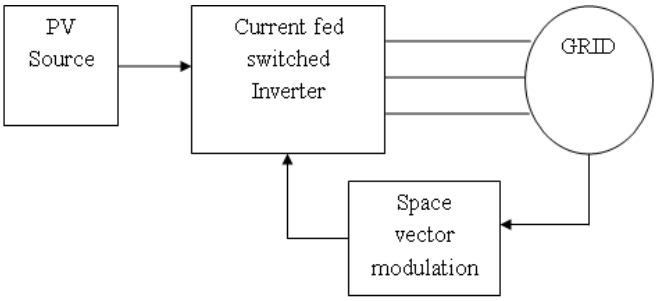

Fig 1: Block diagram of proposed inverter circuit

II. CURRENT FED SWITCHED INVERTER

Current-fed dc/dc converter can give high lift without working at outrageous obligation cycle condition. In the lift converter, the inductor charges the yield capacitor just amid (1-D) interim in an exchanging cycle. Even though, the present current fed dc/dc converter uses both D and (1-D) duty cycle to boost the output voltage to a high value.

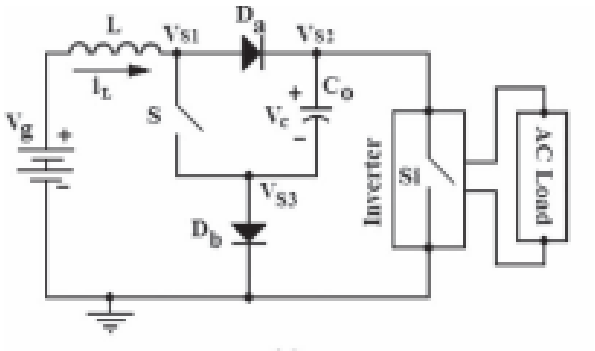

Fig 2: Current fed Switched Inverter

The circuit diagram of current fed switched dc/dc topology (CFT) is shown in Fig. 2. Under constant conduction mode (CCM) operation, in D interval (position 1 of the switch), the output terminals are associated over the inductor and ground. In D (position 0 of the switch) duty cycle, the output terminal associations are turned on. The boost factor of proposed inverter is

$$B = \frac{V_c}{V_g} = \frac{1}{2D - 1}$$

When the duty ratio of the proposed converter is between 0 to 0.5. The controlled switches and the detached switches are traded keeping in mind the end goal to get the CCFT structure

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from the CFT structure. The proportionate circuits of the CCFT converter in the D and D duty ratio are appeared in Fig. 3(a) and (b), separately. Utilizing inductor volt-second adjust, the relentless state yield to include transformation proportion can be determined as

$$B_{CFT} = \frac{V_c}{V_g} = \frac{1}{1-2D}$$

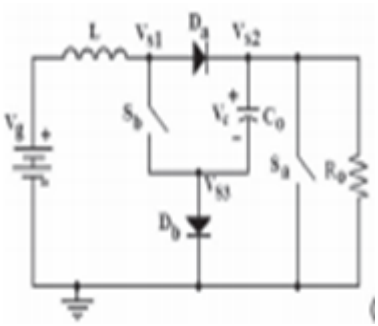

Fig 3 (a): Load Shifting to the switching terminal

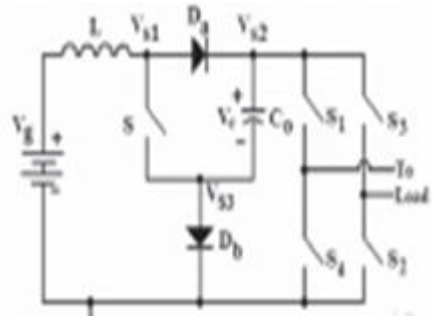

Fig 3 (b): CFSI topology

In both buck and boost operation is achieved in the current fed switched inverter. The EMI noise is reduced and the single stage dc-ac inversion ability.

III. CONTROL TOPOLOGY

The pulse width modulation is used to generate the switching pulse of the proposed inverter method. The sine, triangular and constant voltage is compared and to generate the pulse of CFSI. The pulse pattern of Current fed switched inverter is shown in fig 4.

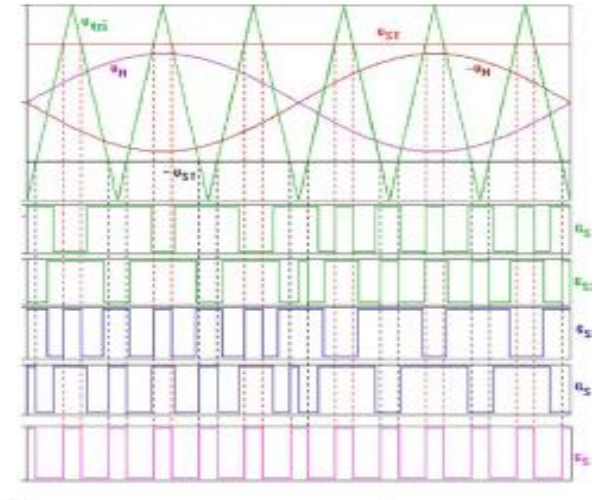

Fig 4: Generation of PWM signal

IV. SIMULATION RESULTS

The proposed current fed switched inverter is shown in fig 5. The PV voltage and current waveform is shown in fig 6. The AC voltage and current waveform is shown in fig 7. Table 1 indicates the parameters of proposed current fed switched inverter.

Parameter	Value
Input voltage	80V
Modulation frequency	50Hz
Carrier frequency	10KHz
Inductor	800 μ H
Capacitor	900F
Filter Inductor	4.6mH
Filter Capacitor	8.5 μ F

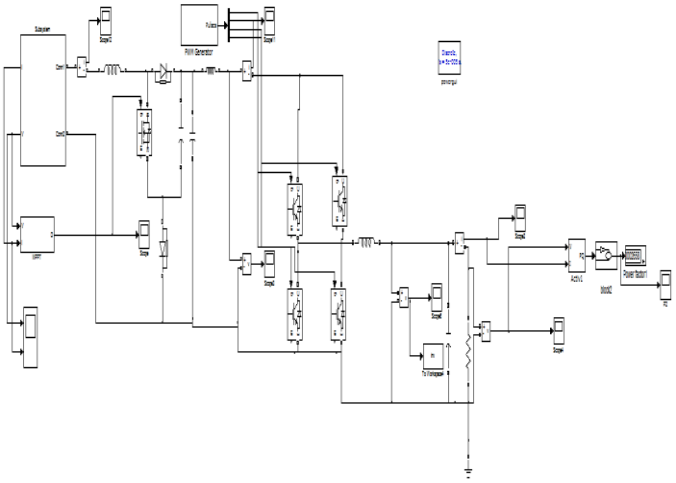

Fig 5: Current fed Switched Inverter

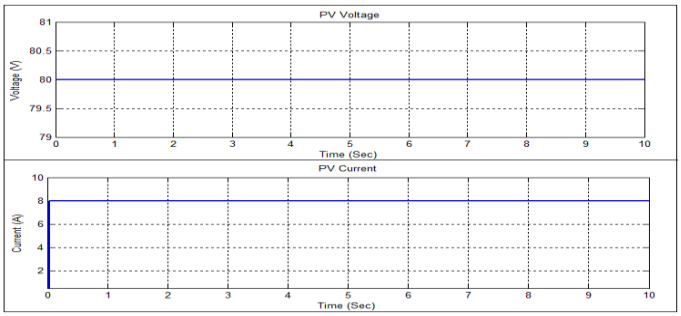

Fig 6: PV voltage and current

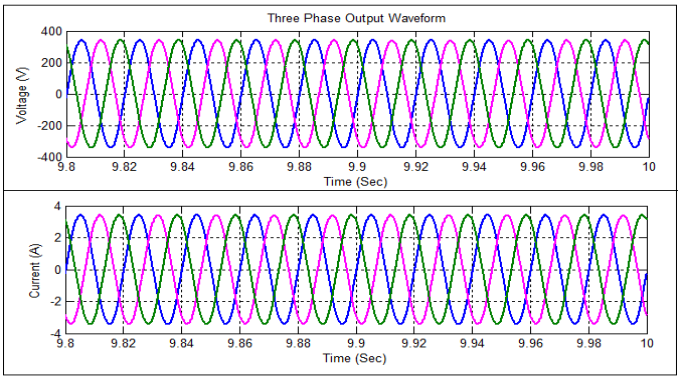

Fig 7: Three phase voltage and current waveform

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V. CONCLUSION

The proposed current fed switched inverter has generated high voltage gain at the output. This converter generate the continuous current, less EMI and used as a single stage power conversion. The modulation index is differs from 0 to 1. PWM control technique is utilized for the inverter. Therefore the converter with the proposed control can accomplish less high recurrence input current swell than that by utilizing customary interleaving innovation with variable obligation cycle control. The step channel can adequately decrease the low recurrence input current swell when the heap is a solitary stage inverter.

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