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Implementation of Single Phase PV Based Three Switch Three Port Fly back Inverter with Series Decoupling Circuit for Grid Application

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Abstract*—The Grid-Connected Photovoltaic (Pv) Generator Has Nowadays Become More Popular Because Of Its Reliable Performance And Also Its Ability To Generate Power From Clean Energy And Renewable Energy Source Based Distributed Generation (Dg)System Are Normally Interfaced To The Grid Through Power Electronics Converter Or Inverters. The Pv Based Standalone Systems Are Evolved As An Attractive Solution Forthe Issue Of Electrification In Where The Grid System Is Not Available. In Single-Phase Grid Connected Pv System, The Input Power Is Constant During The Line–Frequency Period, While The Output Power Oscillates At Double-Line Frequency.Hence A Series Active Power Decoupling Circuit Utilizing Thin Film Capacitors Is Incorporated To The Fly Back Inverter To Handle Input And Output Power Differences. Sothe Low Reliable Electrolytic Capacitors Are Replaced With Small, Long Lifetime Thin Film. In Order To Verify These, Theoretical Analysis And Simulation Are Performed. The Matlab/Simulink Based Simulations Demonstrate The Betterment Of The Proposed Scheme.*

Keywords: *Pv, Dg, Matlab, Pdc*

I. Introduction

Generallyphotovoltaic (PV) has plays major role in renewable energy [1]. The inverters for PV systems have been categorized into three types:

1. Centralized inverter
2. String inverter
3. AC module

Recently, the AC module has attracted solution for the attention of both researchers and industry due to its more advantages such as:

- Improved energy harvest
- Improved system efficiency
- Low installation costs
- Plug-n-play operation
- Enhanced flexibility and modularity.

With these advantages, the AC module has become the trend for future PV system development. In order to provide improve in the inverter performance, and adding a sinusoidal current to the grid, many power decoupling circuits (PDC) have been implemented, the types are follows:

- Passive power decoupling circuits with passive components
- Active decoupling circuits with semiconductor switches

In the passive power decoupling circuits, a large storing device, typically electrolytic capacitor, is used to handle the input and output power differences.

In the active power decoupling methods have been implemented to overcome the problem present in the passive power decoupling circuits [3].

A Flyback-based inverter utilizing three switches is proposed able to recover the leakage inductance energy of transformer without extra elements. Although it can achieve power decoupling, its control algorithm is complicated and it is vulnerable to the circuit parameter variation.In this paper proposes a new single-stage AC module with series power decoupling capability for connecting PV to a single phase power grid. It is able to handle the input and output power differences using small thin film capacitors and a modified three-switch three-port fly back converter. It realizes power decoupling with just three switches and three diodes.

II. Existing System

A. BLOCK DIAGRAM

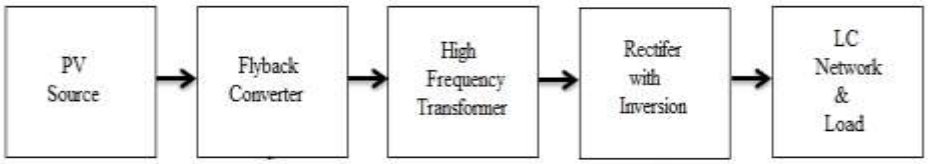

Fig.1 Block Diagram for Existing System

B. CIRCUIT CONFIGURATION AND DESCRIPTION

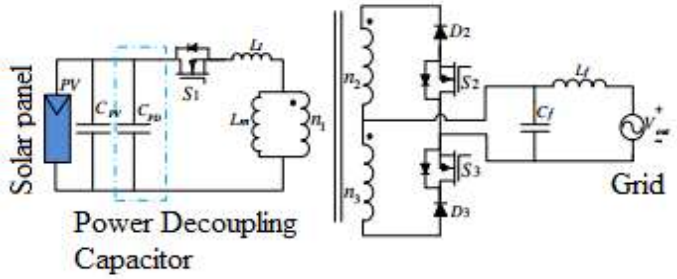

Fig.2 A Grid-connected Flyback inverter

The above Fig.2 shows the grid connected Flyback inverter. The input power is a constant value which is determined by PV source. The output power is time-varying and includes both DC and AC parts.

The Active power decoupling techniques are the method to compensate the power differences using long lifetime thin film capacitors and active switches. The switches are controlled by the extra energy is conveyed from PV to the decoupling capacitor when the input power is more than the output power. The energy of the decoupling capacitor transfers to the output when the input power is less than the required grid power. In three-port power decoupling methods, one port is dedicated for power decoupling while the other two ports capture the input power and deliver it to the output [2].

C. SIMULATION RESULT

In the Existing system circuit with RL load input source are PV panel it's give it to the switch-1. If we use one ideal switch and two MOSFET switches, The each input source value are monitor by use scope each and every values can be monitor.

The input source of the solar energy it gives to 60V and the output are two terminals are fed to the transformer. Here we used the linear transformer in secondary side split into two terminals are connected each terminal having respected switches (S_2 and S_3).

The linear transformer is step up transformer to step up the voltage it gives in to the RL load. The respective waveforms are shown. The conventional circuit diagram with RL load show in Fig.3

I.TABLE

Design Parameter of Existing System

PARAMETER	VALUE	UNIT
Grid Frequency f_{grid}	50	Hz
Input Capacitance C_{in}	100	µF
Leakage Inductance L_{lk1},$L_{lk2,}$ L_{1k3}	0.007, 0.05,0.05	mH
Magnetizing Inductance L_{m1},L_{m2}	8.28	µH
Filter Capacitance C_f	2.3	µF
Filter Inductance L_f	10	µH

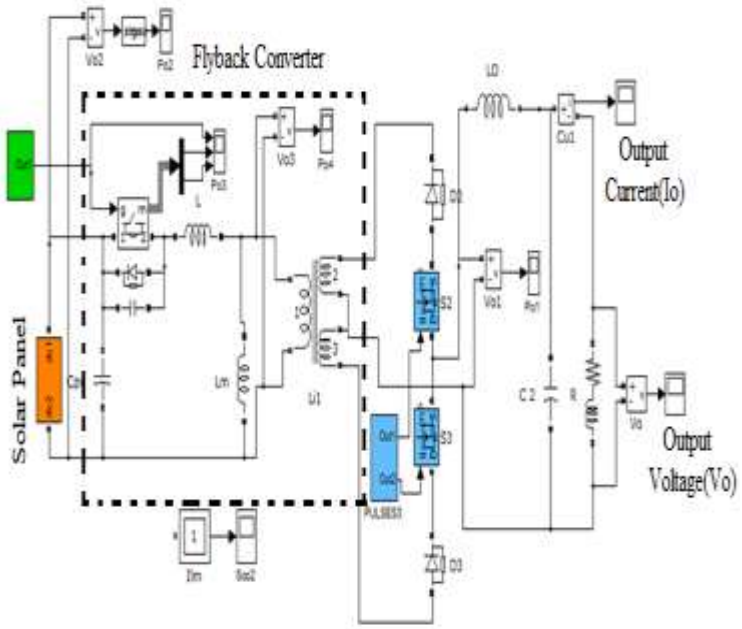

Fig.3 Simulation for the Existing System

The below Fig.4 shows the (L_m) mutual inductance is connected across in the transformer. In the inductance are storage the charge when the switch are ON condition and the switch are OFF condition the L_m inductance are discharge. Theoutput waveform for the current through the Lm inductance.

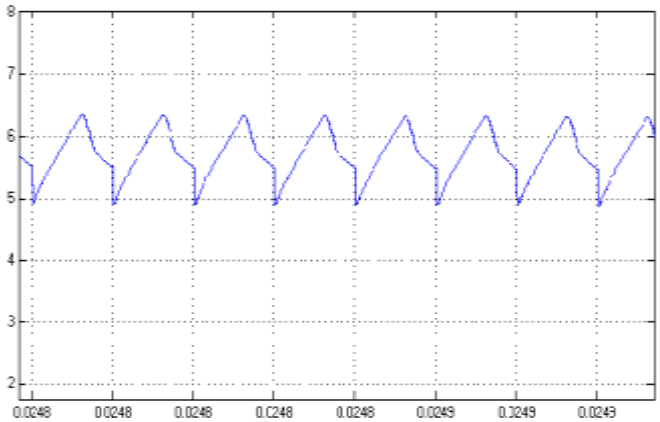

Fig.4 Current through inductor L_m

The below Fig.5 shows theInput voltage of the primary side of the step up transformer.

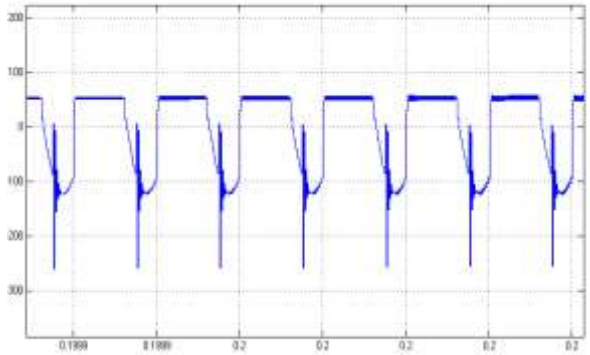

Fig.5 Transformer primary side voltage

The below Fig.6 shows the Output Current waveform. In this waveform the maximum current attains the 0.4A **.**

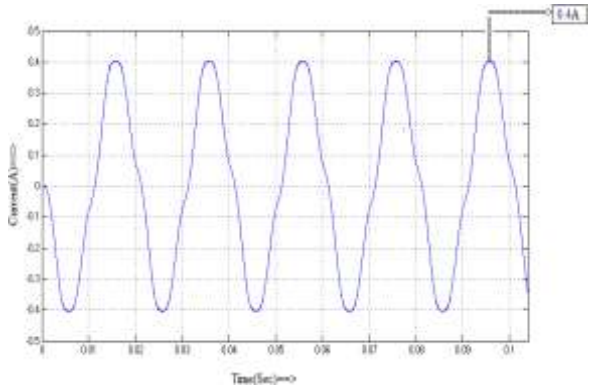

Fig.6 Output current

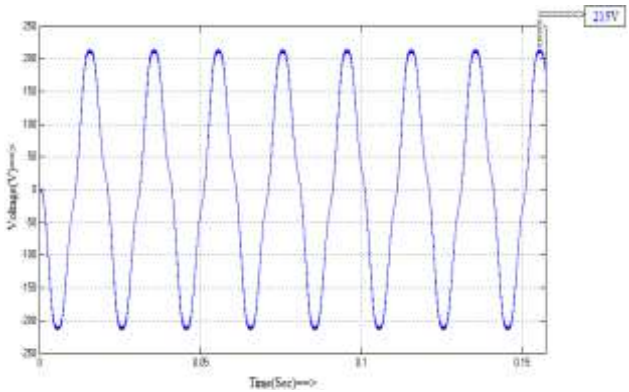

Fig.7 Output voltage

The above Fig.7 shows the Output Voltage waveform. In this waveform the maximum voltage attains 215V**.**

III. Proposed System

A. BLOCK DIAGRAM

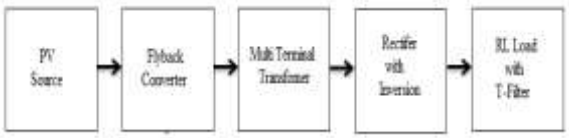

Fig.8 Block Diagram for Proposed System

B. SIMULATION RESULT

In the Proposed system circuit with RL load input source are PV panel it's give it to the switch-1. If we are use one ideal switch and two MOSFET switches. If the each input source value are monitor by use scope each and every values can be monitor.

The input source of the solar energy it gives to 60V and the output are two terminals are fed to the transformer. We use linear transformer in secondary side split into n terminals are connected each terminal having respected switches (S_2 and S_3).

The linear transformer is step up transformer modified as multi winding transformer to step up the voltage it gives in to the RL load. The output we use T-filter two inductance and one capacitor connected in T-shape it will reduce harmonic distortion. The respective waveforms are given below figure. The conventional circuit diagram with RL load show in Fig.9

II.TABLE

Design Parameter of Proposed System

PARAMETER	VALUE	UNIT
Grid Frequency f_{grid}	50	Hz
Input Capacitance C_{in}	470	µF
Leakage Inductance L1 L2 ... Ln	0.002 0.002 0.02 0.02	mH
Magnetizing Inductance L_{m1}	0.5	mH
Filter Capacitance C_f	2.2	µF
Filter Inductance L_f	0.25	µH

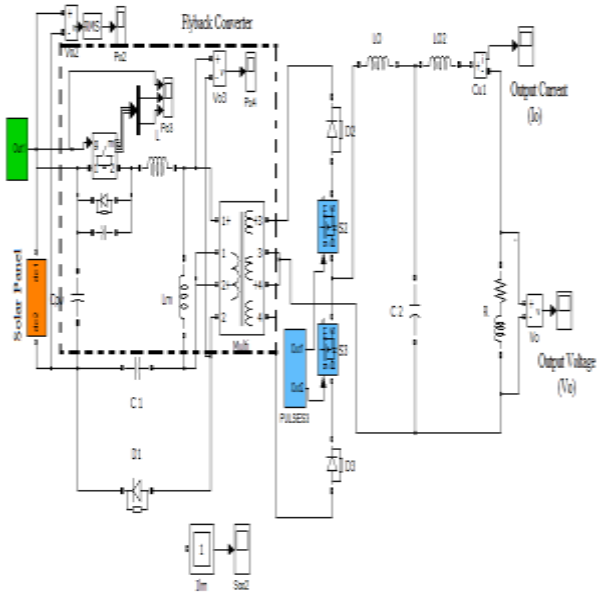

Fig.9Simulation for the Proposed System

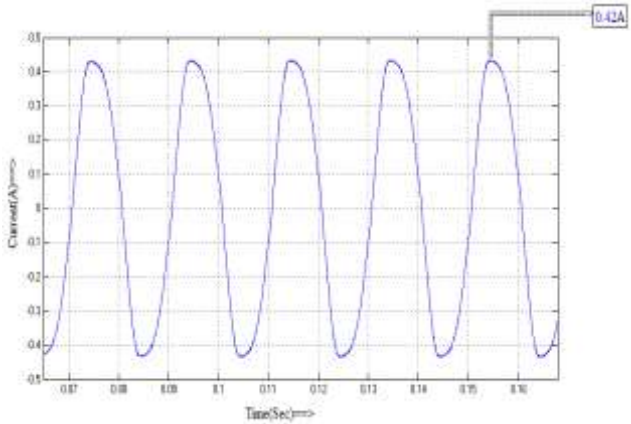

Fig.10 Output Current

The above Fig.10 shows the output current waveform. In this waveform the maximum current attain 0.42 A**.**

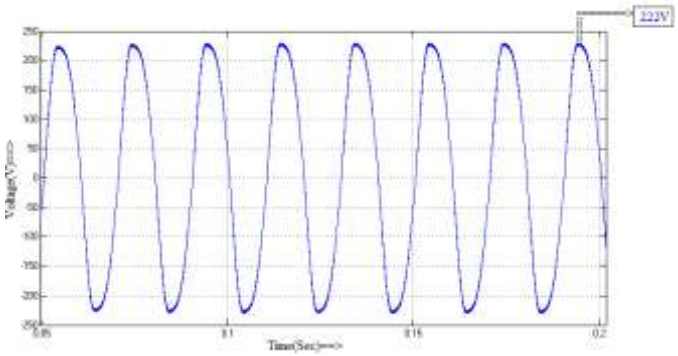

Fig.11 Output Voltage

The above Fig.11 shows the output voltage waveform. In this waveform the maximum voltage attains 222V.

IV. Comparison Of Existing And Proposed System

In the above simulation outputs both the existing and proposed results are shown. The comparison of both the results gives the performance of the system. The parameters of the proposed system gives the better results as compare to the existing result are shown in below III.Table.

III.TABLE
Comparison of Existing And Proposed System

SL. NO	PARAMETER	EXISTING SYSTEM	PROPOSED SYSTEM
		VALUE	VALUE
1	Input voltage (V)	60	60
2	Output voltage (V)	215	222
3	Output current (A)	0.4	0.42
4	Leakage Inductances (mH)	0.007, 0.05, 0.05	0.002, 0.002, 0.02,
5	Voltage Spike (V)	4	2
6	THD (Hz)	11.29	6.04
6	Efficiency (%)	72	89

V. Conclusion

The Flyback converter has become an unavoidable component because it having advantages of fewer components, simple in construction and also it provide the isolation between PV and the grid.

TheFlyback based three switch converter is proposed in this project. The circuit performance is verified with help of simulation results.

This existing system has more power loss due to transformer leakage inductance. This problem is overcome in the proposed system with the help of decoupling circuit.

The Proposed Flyback converter system characteristics are analyzed with the help of waveform.

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