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Module Integrated Analog Photovoltaic DMPPT Tracker

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ABSTRACT

With the increasingly urgent energy issues, the world attaches great importance to begin the development of new energy and related technology. At present, large scale photo-voltaic power generation and scale of renewable energy has become parts of development strategy, meanwhile it is the way to guide the development of photo-voltaic industry. However, because of its own characteristics different from conventional power generation grid connected PV power station and its security, stability, reliable operation become new challenges which power grid and PV power plant need to face. This paper proposes a new power control concept for grid-connected photo-voltaic (PV) inverters. The new control strategy is based on combination of a constant power generation (CPG) control with a distributed maximum power point tracking control (DDMPPT) depending on the instantaneous available power from the PV panels. The essence of this concept lies in the selection of an appropriate power limit for the CPG control to achieve an improved thermal performance and an increased utilization factor of PV inverters. Ultimate objective is to cater for a higher penetration level of PV systems with intermittent.

I. INTRODUCTION

Renewable energy is the energy which comes from natural resources such as sunlight, wind, rain, tides and geothermal heat. These resources are renewable and can be naturally replenished. Therefore, for all practical purposes, these resources can be considered to be inexhaustible, unlike dwindling conventional fossil fuels. The global energy crunch has provided a renewed impetus to the growth and development of Clean and Renewable Energy sources. Clean Development Mechanisms (CDMs) are being adopted by organizations all across the globe. Apart from the Srapidly decreasing reserves of fossil fuels in the world, another major factor working against fossil fuels is the pollution associated with their combustion. Contrastingly, renewable energy sources are known to be much cleaner and produce energy without the harmful effects of pollution unlike their conventional .counterparts. . This paper ends up with an overview of synchronization methods and a discussion about their importance in the control. .

In this method, the dwelling time of vector calculation is derived from two-level inverter. By using a linear transformation, the dwell time of vectors for two-level VSI can be transformed for multi-level VSI[1]. . The most important properties an input source should have in order to emulate a real PV generator are defined. These properties are important, since a power electronic substitute is often used in the validation process instead of a real PV generator. This paper also qualifies two commercial solar array simulators as an example in terms of the defined properties[2]. , the presented method is applied to the grid side inverter to show its validity. A power cycling test is designed to gather the lifetime data of a selected insulated gate bipolar transistor (IGBT) module (SKM50GB123D). Die-attach solder fatigue is found out to be the dominant failure mode of this IGBT module under the designed accelerated tests. Furthermore, the crack initiation is found to be highly stressing dependent while the crack propagation is almost independent with stress level.[3] The small voltage vectors of an NPC inverter affect the neutral-point voltage. The N-type small switching state decreases the neutral-point voltage, and the P-type small switching state increases the neutral-point voltage when the inverter is in normal operation (inverting mode).[4] . The elementary PV device is the PV *cell*. A set of connected cells form a *panel*. Panels are generally composed of series cells in order to obtain large output voltages. Panels with large output currents are achieved by increasing the surface area of the cells or by connecting cells in parallel. A PV *array* may be either a panel or a set of panels connected in series or parallel to form large PV systems[5]

II. PROPOSED SYSTEM

The main objective of this system is to design DC-DC DMPPT circuit using chaotic pulse width modulation to track distributed maximum power from solar PV module for space application. The direct control method of tracking is used to extract maximum power. The nominal duty cycle of the main switch of DC-DC LUO converter is adjusted so that the solar panel output impedance is equal to the input resistance of the LUO converter which results better spectral performance in the tracked voltages when compared to conventional PWM control. The conversion efficiency of the proposed DMPPT system is increased when CPWM is used as a control scheme.

The single-phase two-stage configuration is preferable for residential PV applications. The control structure of a two-stage single-phase PV system with the proposed control concept is which indicates that the hybrid control strategy is implemented in the control of the boost stage depending on the instantaneous available power of the PV panels, the actual output power of the PV panels can be expressed as where *Po* (*t*) is the output power of the PV panels (i.e., input power of the power conversion stage), *P*PV(*t*) is the available maximum power of the PV panels, and *L*imit is selected by taking into account the tradeoffs among the thermal performance (lifetime) of power devices, the PV inverter utilization factor, and the annual energy yield. As the available PV power is weather-dependent, the operation modes will alter accordingly with the solar irradiance and ambient temperature. Exemplifies different operation regions for a single-phase PV system during a day with the proposed control strategy the operation principle of the proposed hybrid DMPPT-CPG control can be described as follows. When PPT (*t*) ≥ P limit , the system enters into CPG operation mode and the DMPPT control is deactivated. The PV output power is regulated by a proportional controller (*K*CPG) to maintain the output power constant (i.e., *Po* (*t*) = P limit). When *PP V* (*t*) <Limits, the system maximizes the output power with an DMPPT control, and thus the CPG control is disabled.

The CPG control can be achieved by diverting the operating point from the maximum power point, if the available power of the PV panel exceeds the power limit when the solar irradiance is increased from0.8 kW/m2 to 1 kW/m2.The operating point of the PV panels either moves to “L” or “H” rather than “M”. Accordingly, the Operating point of the PV inverter is changed. There are three Alternatives of the control variables for CPG control: VPV, IPV, and Or PPV. The first two control options can be achieved on a basis of the existing power point tracking algorithms, e.g. Perturb and Observe (P&O) and incremental conductance methods the third one is applied in this study by using *L*imit as A power reference since it is relatively simple. It is worthwhile investigating the dynamic performance of different implementation Methods, which is beyond the scope of this system and is considered as a further in-depth study. Additionally, the selection of *L*imit should be compromised with the energy loss defined the dependency of energy reduction on *L*imit for a 3-kw PV system operating under a specific yearly mission profile. The energy Loss is increased with the reduced value of P limit. For example, a 20% reduction of the maximum feed-in power will result in a 6.23% reduction of the annual energy production. Correspondingly, the PV inverter utilization factor is increased by 17% (i.e., 1−0.0623 0.8 − 1). Further trade-off design factors, such as the impact on the lifetime of PV inverters and the cost-of-energy of The PV systems, are not covered in this system.

Solar energy is one of the clean energy sources without polluting environmental pollution. The PV array can feed power to the system through a DC-DC converter. A distributed Maximum Power Point Tracking (DMPPT) control technique is required for the PV system to operate at the distributed maximum power point. Many DMPPT methods have been suggested over the past few decades. But P&O control technique has the advantage of an easy implementation to extract maximum power from PV.

The DC-DC converters are used to convert a DC power at one voltage level to another one. In recent years, the modern power electronic systems require power supply with high reliability, high efficiency, low input ripple. In all DC-DC converter voltage and efficiency is limited by parasitic elements. LUO Converters are newly developed DC-DC converter to overcome the above limiter effects.

LUO converter with Voltage Lift (VL) Technique is a popular method widely used in electronic circuit design. It can be a good way of improving DC-DC converters characteristics and has been successfully applied for DCDC converters. However, the output voltage increases in stage by stage just along the arithmetic progression.

III. BLOCK DIAGRAM

Figure .1 shows the block diagram of proposed system.IT includes battery, inverter, sensor LUO converter and chaotic PWM generator.

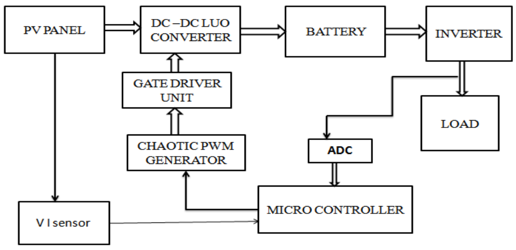

Figure1.Block Diagram Of Proposed Method

DETAILS OF PERTURB & OBSERVE ALGORITHM

The Perturb & Observe algorithm states that when the operating voltage of the PV panel is perturbed by a small increment, if the resulting change in power P is positive, then we are going in the direction of MPP and we keep on perturbing in the same direction. If P is negative, we are going away from the direction of MPP and the sign of perturbation supplied has to be changed. Figure .shows the characteristics of module voltage mode current power.

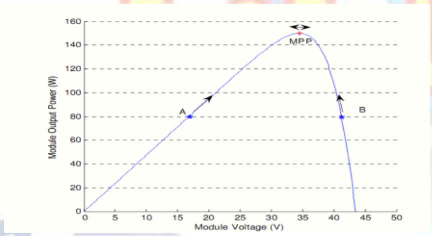

Figure2.characteristics of module voltage-mode current power

IV. CHARACTERISTICS OF DMPPT AND OPERATING POINTS A AND B

Solar panel characteristics showing MPPT and operating points A and shows the plot of module output power versus module voltage for a solar pan el at a given irradiation. The point marked as MPP is the Maximum Power Point, the theoretical maximum output obtainable from the PV panel. Consider A and B as two operating points. As shown in the figure above, the point A is on the left hand side of the MPP. Therefore, we can move towards the MPP by providing g a positive perturbation to the voltage. On the other hand, point B is on the right hand side of the MPP.

When we give a positive perturbation, the value of P becomes negative, thus it is imperative to change the direction of perturbation to achieve MPP. The flowchart for the P&O algorithm is shown in Figure 3.

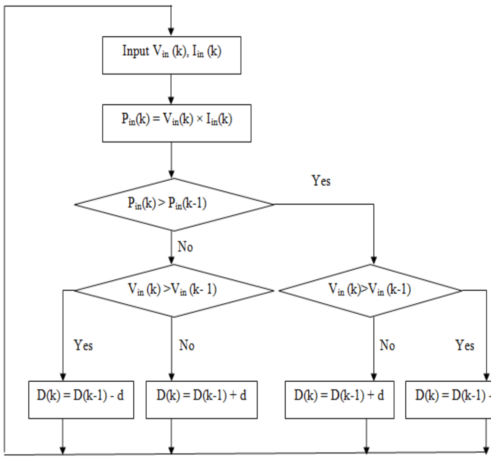

Figure3.Flowchart of perturb & observe algorithm

Simulink Model of MPPT

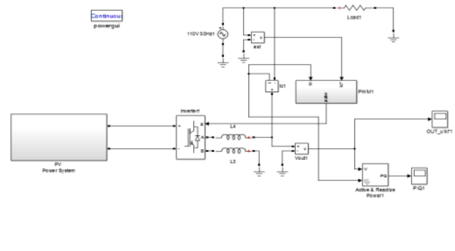

Figure4.Siulink model of MPPT

OUTPUT VOLTAGE OF INVERTER IN BOOST MODE

Figure 5.shows the output waveform of inverter.
Figure 6.shows the battery output voltage waveform

Figure5.Inverter Output Waveform

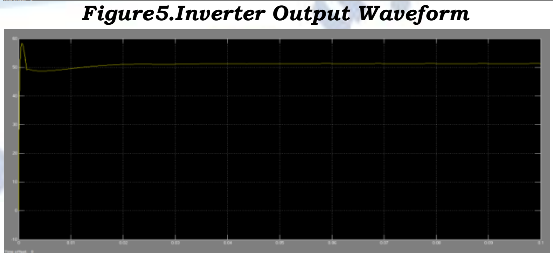

Figure 6. Battery Output Voltage Waveform

A Solar PV module is mathematically modeled and connected at the DC input of the DC –DC LUO Converter. In order to switch the converter two complementary pulses were generated at a switching frequency. And in order to track the maximum power point using Perturb and Observe (P&O) algorithm is also implemented in the simulation and which will vary the duty cycle according to the Vmpp&Impp. Figure 5.8 shows the output current and voltage wavefo Figure fig7.Output current and voltage waveform of PV panel.

The duty cycle 'a' can be generated by comparing the reference dc signal Vr with a sawtooth carrier signal Vcr. This is shown in fig(e),Modulation index is the ratio of carrier signal to reference signal the duty cycle a can be varied from 0 to 1.To obtain the square wave pulses compare these signals by a comparator to generate the difference (Vc-Vcr).Any variation in Vcr varies linearly with the duty cycle.

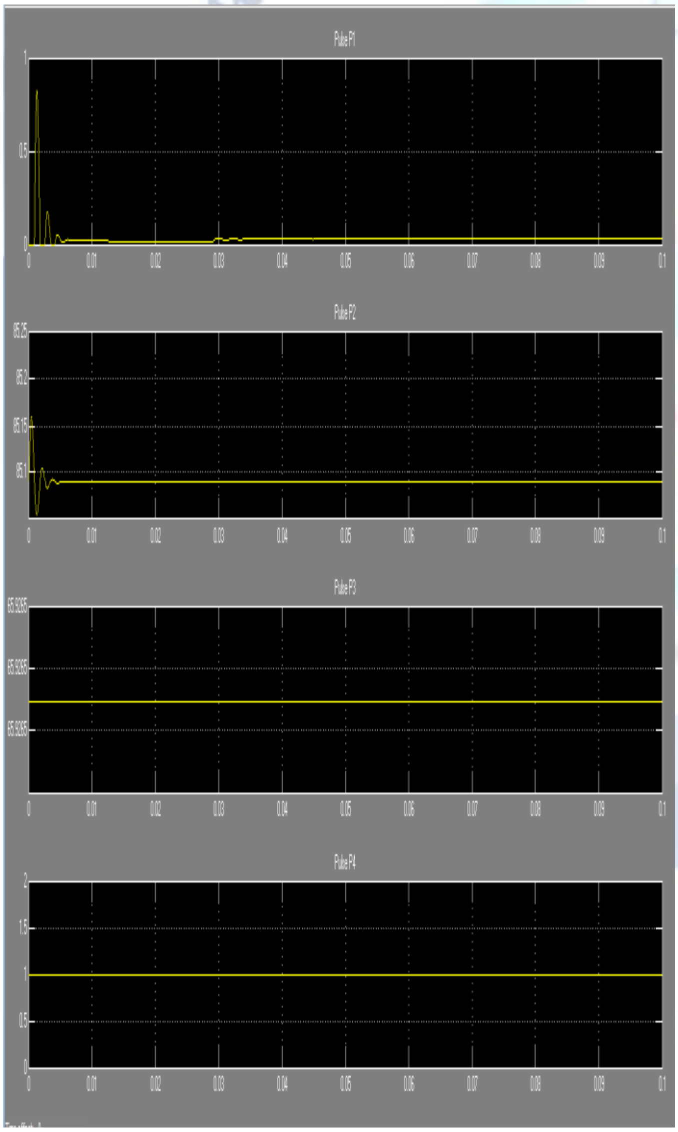

Figure7.output current and voltage waveform of pv panel

V. CONCULSION

A hybrid DMPPT–CPG control concept is proposed for grid connected PV inverters by considering the long-term mission profiles and the system level power management requirements.

Aforementioned advantages are compromised with the energy loss due to the proposed control, allowing the optimal selection of the power control limit depending on specific mission profiles. In the study case of a single-phase PV inverter, the power limit is selected as 80% of the maximum feed-in power of the PV panels, which is corresponding to a 6.23% energy yield reduction under a specific yearly mission profile. The PV inverter utilization is increased by 17% and the lifetime of the power devices is extended to 5.62 times of that in DMPPT control mode. The proposed control strategy enables to increase the utilization factor of PV inverters and to reduce the temperature variations on power devices. Moreover, it is beneficial to system level power management by smoothing and limiting the PV inverter output power to some extent. This benefit is especially important to increase the PV installations with the existing grid infrastructure under a high PV penetration degree in the future. The power devices is extended to 5.62 times of that in DMPPT control mode The effectiveness of the proposed topology and control algorithm was tested using simulations and results are presented. The results demonstrate that the proposed system is able to control ac-side current, and battery charging and discharging currents at different levels of solar irradiation.

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