

ENERGY MANAGEMENT AND CONTROL STRATEGY OF PHOTOVOLTAIC/BATTERY HYBRID DISTRIBUTED POWER GENERATION SYSTEMS WITH AN INTEGRATED THREE-PORT POWER CONVERTER

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ABSTRACT— Photovoltaic (PV)/battery hybrid power systems have received a lot of interest lately. For typical distributed power generating systems using PV/battery hybrid power units, two separate power converters a unidirectional dc-dc converter and a bidirectional converter are usually needed. This research offers an energy management and control method for PV/battery hybrid distributed power generation systems with just one integrated three-port power converter. Since the integrated bidirectional converter shares power switches with the full-bridge dc-dc converter, the system's power density and reliability are boosted. In order to establish power balance across three ports in a variety of operating circumstances, the suitable energy management and control technique is proposed, taking into account both the MPPT benefit and battery charging/discharging management. The proposed PV/battery hybrid distributed power generation system with the appropriate control algorithms is simulated using Matlab/Simulink software, with the MPPT control loop and the battery charging/discharging management loop enabled in various operational scenarios.

Keywords: *MPPT, PV, DC bus, micro grid.*

I. INTRODUCTION

The microgrid's renewable electricity assets have a fairly high permeability, and their periodic nature will clearly motive the device's energy deliver to vary. The gadget's functionality to run regularly may be risked

by way of the fast adjustment in masses similarly to button that permits you to truly additionally develop voltage flicker similarly to a dip within the DC bus. A grid converter, battery strength garage place, sun power generation, and a DC microgrid moreover, the manner control technique of the microgrid is developed to understand the independent technique of the microgrid, which consist of parallel in and additionally off the grid, based totally upon the bus voltage data. It is made use of because the studies things load on this studies take a look at. The list beneath century noticed large development, together with the producing of induction and additionally synchronous machines, electric powered metres, excessive voltage transmission, gasoline mills, atomic power flora, wind mills, sun photovoltaic or pv, as well as, amongst others, fuel generators in addition to atomic energy plant life. All of those improvements had been related to the introduction, development, in addition to growth of "the grid"-- a machine of pretty centralized power manufacturing connected to a network of power customers. While cash and attempt have been being put into "the exceptional tool ever created," an extra study fad raised in cutting-edge years as people began out to reflect on consideration on the blessings of going inside the opposite commands with dispersed, decentralised, little grids, or microgrids. By their very nature, batteries and truly capacitors appoint dc gift for billing as well as discharging. This likewise relates to the batteries in electric powered vehicles, demonstrating exactly how essential it is to

link dc electricity structures with car-to-grid systems. In addition to the advantages of higher electrification, one extra vital location of have a observe seeks one of the most cheap approach to raise accessibility to energy. In a spread of researches, the consequences of grid increase, decentralised technology, solar house structures (SHS), solar photovoltaic or pv (PV) microgrids, in addition to a three-manner comparison of grid expansion, renewable-primarily based definitely house systems, and renewable-based microgrids were contrasted. Each of these researches takes a take a look at the assets, fuel, transmission, further to float costs associated with the RE options gift. According to the searchings for of these research, decentralised selections are a long way extra price-green in rural and/or cautiously populated places, regardless of the fact that grid extension is commonly the least expensive opportunity for RE. Especially, it turned into discovered that off-grid power structures may want to high-quality provide over 50% of the population in lots of Sub-Saharan African countries. Additionally, the present day speedy fall in solar PV costs recommends that in choice to lowering, the place where SHS and additionally PV microgrid systems are the very extraordinary preference will in fact increase.

READING STUDY

Power layout is the procedure of dispersing electrical power from a supply to its customers. It is important to the fulfillment of the world. It's viable that till they are no extra available, we take the air we breathe and the water we consume for authorized. Energy conversion techniques are the number one reputation of electricity layout. 4 classifications of required tools are installation: Examples of AC/AC transformers embody AC/DC rectifiers,

DC/DC converters, and DC/AC inverters. DC/DC converter manufacturing composes the most important part of the turnover of all conversion equipment, steady with cutting-edge reviews. The field of DC/DC conversion generation is growing unexpectedly. Uncompleted data endorse that there greater than 500 distinctive DC/DC converter geographies in use, as well as a lot extra are being created each yr. It is a massive task to cope with such a selection of DC/DC converters.

CONVERTER DC-DC

When we want to correctly convert DC electric powered strength from one voltage stage to 1 extra, we employ DC-DC converters as virtual tool. They are called for due to the fact, in assessment to a/c, DC can't be boosted or decreased the usage of a transformer. A transformer and a DC-DC converter have numerous attributes.

The dc-dc converters can be in contrast to dc transformers that generate voltage or existing stages that change from those of the input supply. This dc modification, like in traditional transformers, is generated with the aid of digital changing in preference to electro-magnetic strategies. Dc-dc converters are utilized in a variety of regulated switch-mode dc strength products and moreover dc motor power programs.

DC-DC converters are inherently nonlinear. High-universal performance control is a difficult undertaking for designers in each control engineering and additionally electricity electronic gadgets. As an entire, a gifted dc-dc converter control makes certain balance in every operating circumstance. A not unusual manage method likewise calls for an powerful response to input voltage adjustments, heaps variant being rejected, and even specification uncertainty.

Much artwork has entered into

developing modelling and control treatments for quite a number dc-dc converters due to groundbreaking studies examine into dc-dc converters. The traditional direct technique is primarily based upon country averaging techniques to create the dominion-location balanced equations. The use of a vicinity balanced version presents potential disturbances in the U.S.A. Variables surrounding the running component. These equations may be used to determine switch capabilities for open-loop plant life. It will be very easy to create an instantaneous controller based at the switch feature. DC to DC converters are wanted for battery-powered mobile electric powered equipment like cellular smartphone and also computer. Sometimes, the ones electrical equipment have numerous sub-circuits, every with a name for for a voltage diploma this is numerous from the battery or an outside useful resource (from time to time better or much less than the supply voltage, and additionally probable also terrible voltage). Additionally, the voltage of the battery decreases because the battery's energy strength is used up. Switched DC to DC converters offer a method to raise voltage from a partially decreased battery voltage, lowering room, instead of needing many batteries to benefit the identical give up end result.

2. A RECAP OF THE RECOMMENDED SYSTEM

More PV panels are being utilized as source of electricity in distributed power manufacturing structures because of upgrades in energy electronics technology [1, 2] As an example, the usage of renewable resource globally (omitting hydro) climbed up by the use of 17% in 2017, with sun strength accounting for added than a third of this increase despite the fact that comprising

absolutely 21% of all green strength technology [3] Without a subject, the most huge option to the routine nature of renewable useful resource assets is strength garage device (ESS) modern-day technology [4-6]

A PV/battery crossbreed strength device is a few of the diverse dispensed power producing structures' maximum vital building block. According to Fig. 1 (a), the not unusual PV/battery crossbreed electricity device primarily based on DC/AC mini grids has not much less than unbiased power converters with a unidirectional DC-DC conversion phase and a bidirectional conversion phase [7]-- [12] (the DC microgrid primarily based system for instance). The ESS, along with the battery, is connected to the DC bus by using way of a bidirectional converter, in preference to the PV, it is connected to it via a unidirectional DC-DC converter. The literary works [7]-- [10] concentrates at the renovation of the manage in addition to electricity control machine primarily based on DC/AC hybrid microgrids, a/c microgrids, as well as DC microgrids, both in grid-related or islanded running setting. A PV/battery hybrid strength device that counts totally on a DC microgrid is the focal point of specific examinations [11] The PV array controller for MPPT, the battery controller for charging/discharging tracking and circumstance of price (SOC) manipulate, and the inverter controller (for air con microgrid systems) are usually covered in a PV/battery hybrid energy device's complete control technique [7] The use of a battery/super capacitor crossbreed energy storage space device in a PV-based totally definitely dispersed strength generation machine is likewise blanketed.

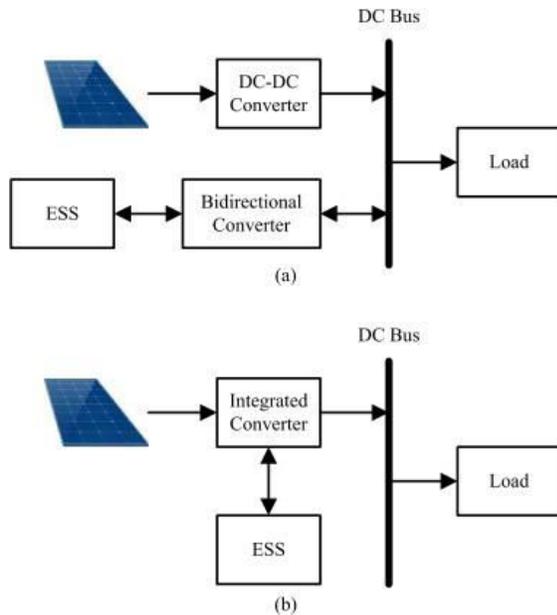


Fig.1. (a) Conventional topology for the PV/battery hybrid power unit with two independent power converters; (b) Proposed topology for the PV/battery hybrid power unit with an integrated three-port power converter.

Fig. Suggests an integrated three-port energy converter because the consumer interface for a PV/battery hybrid energy generating system, it truly is numerous from the ordinary geography (b). Integrating each unbiased converters of the usual geography in Fig. 1 will simply improve the power density of the device (a). The idea, modeling, as well as layout of multiport energy converters for fusing renewable power assets and additionally electricity garage gadgets are offered in [3] The writers declare that because of the reality this sort of discrete tool requires coordinated control of strength go with the float and moreover heaps tenet via the communication channel, the stability further to colorful reaction of a regular multi-converter fashion might be compromised. A multiport converter that connects the source of power, battery, and additionally load can be made the use of a multi-winding transformer that is primarily based on either a

complete-bridge module or a half of-bridge module (see Numbers 14 and additionally 15). On the other hand, this type of multi-winding transformer-based multiport converter might need numerous strength switches, which may clearly lower the strength density whilst growing the value and intricacy of using and additionally regulating it. [16] Suggests a crossbreed PV-wind-battery-load 4-port dispersed power era gadget. An ordinary 1/2-bridge converter may be made into the endorsed four-port topology by using definitely which include 2 electricity switches, developing a device with a excessive energy thickness. A improve-included stage trade entire-bridge three-port converter is suggested in [17] Two growth-protected three-port converter topologies, specifically the symmetric and additionally choppy topologies, are suggested for feasible applications of PV/gas cellular based totally dispersed strength manufacturing structures. Bidirectional power move between the two ports at the primary side of the high-frequency (HF) transformer may be done via varying the challenge cycle of electricity switches. When contrasted to a similar traditional system, using incorporated topologies benefits the device in phrases of raised effectiveness, better electricity density, and moreover less costly fee.

For the PV/battery hybrid power technology device, a covered 3-port DC-DC converter combining an interleaved bidirectional greenback raise converter and additionally a segment change whole-bridge converter is offered. This converter is based totally upon the idea of the symmetrical improve-incorporated three-port topology [18] A PV/battery hybrid 3 port electricity producing machine has in fact been verified to function properly with the proposed PWM with stage attitude shift manage method.

Additionally concept about is the feasibility of growing the geography to generate converters with 4 or more ports. The common voltage distinction in among each switching legs develops inside the choppy structure, which needs a DC obstructing capacitor within the HF hyperlink in assessment to the symmetrical increase-covered three-port format. Based at the muse of the uneven topology for the raise-blanketed full-bridge converter, this newsletter examines the possible software overall performance of the converter in a DC microgrid-primarily based PV/battery crossbreed power tool with an blanketed three-port energy converter. A matched power tracking in addition to manage approach is likewise counseled so that you can attain automated power tracking in addition to advanced tool universal overall performance. Information of the device's feasible approach below distinctive strength problems is given. To establish the stableness of the PV/battery hybrid strength generation device with the provided strength aid, simulations are completed.

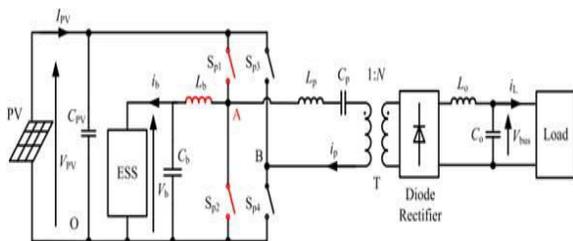


Fig.1. Block diagram.

SIMULATION RESULTS:

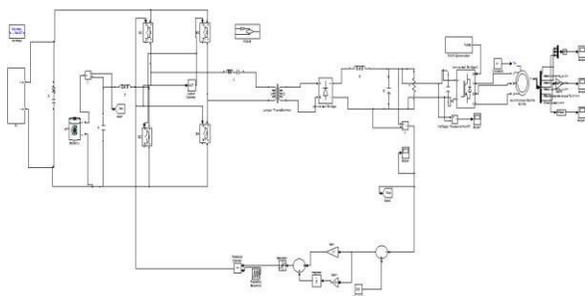


Fig 2 Simulink diagram of Proposed System power converter with Induction Motor drive

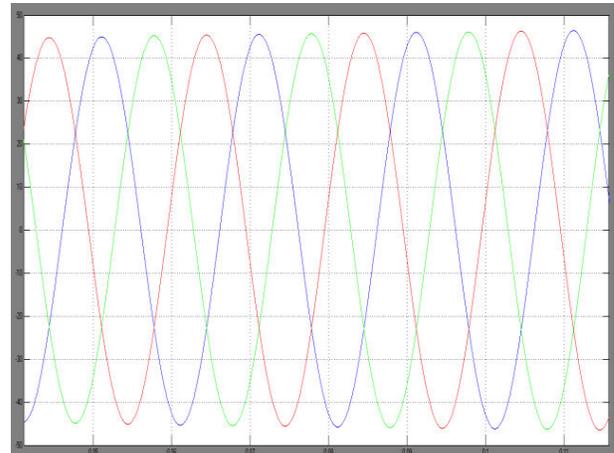


Fig 3 Simulation waveforms of Induction motor drive stator current characteristics

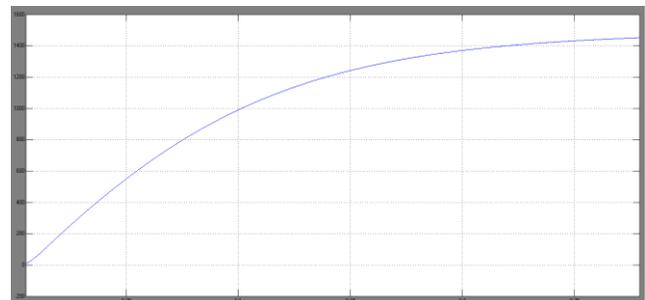


Fig 4 Simulation waveforms of Induction motor drive speed characteristics

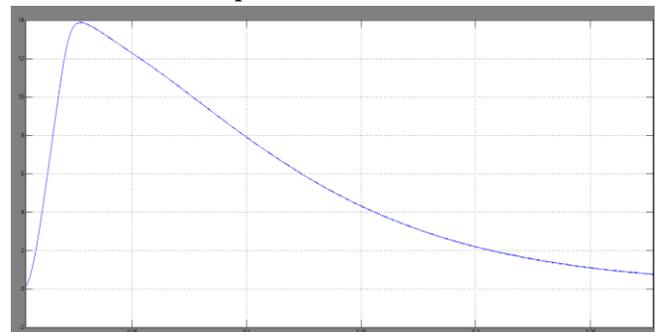


Fig 5 Simulation waveforms of Induction motor drive Torque characteristics

3. CONCLUSION

Induction motor pressure application works as the user interface for a PV/battery crossbreed dispersed energy manufacturing machine within the recommended induction electric powered motor force device, which moreover incorporates an included 3-port strength converter. When as compared to the same old device topology, which includes a separate DC-DC unidirectional conversion section and a bidirectional conversion stage, the advised system, which uses an induction

motor power, uses advantages in terms of stronger energy thickness as well as integrity. The whole bridge degree alternate angle and button obligation cycle are employed as 2 manage variables for you to generate the wished DC bus voltage and attain energy equilibrium amongst 3 ports. An sizeable energy monitoring in addition to manage approach is given therefore of a complete assessment of several gadget going for walks situations below different power situations. Under unique scenarios, the priority controller can enable one of the manage loopholes to improve device performance in well-known while thinking about the blessings of MPPT as well as the needs for handling battery billing as well as releasing. The simulation effects affirm the efficiency of the recommended PV/battery hybrid dispersed strength technology machine and the applicability of the proposed manage approach.

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