

Design and Implementation of Multiprocessing Hybrid System Controlled By ARM Processor

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Abstract: The Segmented Energy Storage management (SES) is the proposed solution of smoothing renewable power generation fluctuations. A SES based hybrid renewable power management system requires a suitable control strategy that can be effectively utilize the maximum power output and Battery State of Charge (SOC). The proposed system represents an efficiency of a renewable hybrid power system simulation analysis undertaken to improve the smoothing performance of BESS. The hybrid power generation and then smart grid proposes the effectiveness of the battery SOC control. The power control method is a reducing the hybrid output power fluctuations and regulating the battery SOC under the typical conditions is proposed. A real time based SES power allocation method and ARM controller also has proposed. All the above stated switching techniques are simulated using the MATLAB at a frequency of 10 kHz.

Index Terms: SES, SOC, PV, BESS, MATLAB

I. INTRODUCTION

The renewable energy power generation is very important for in recent years. The battery power energy storage system can provides for flexible energy management solutions. It helps to an improves the power quality of renewable-energy hybrid power generation systems. They are several control strategies and configurations for hybrid energy storage systems, such a battery energy storage system, superconducting magnetic energy system (SMES), a flywheel energy system (FES), an energy capacitor system (ECS), and a fuel cell/electrolyzes hybrid system have been proposed to smooth wind power fluctuation or enhance the power quality. The rapid development of a battery energy storage systems recently have been utilized for multiple applications such as frequency

regulation, grid stabilization, transmission loss reductions, diminished congestion, increasing reliability, wind and solar energy smoothing, spinning reserve, peak shaving, load leveling, uninterruptable power resources, grid services, electric vehicle (EV) charging stations, and others. The smart grid electric charge provider helps to provide a usage amount of power. It eliminates the demand power. These vehicles can be easily recharged during off peak hours at cheaper rates while helping to absorb excess night time generation. BESS (Battery Energy Storage Station) used to illustrate the procedure of the current and typical means of smoothing wind- or solar-power generation fluctuations. Such a BESS hybrid power system requires a suitable control strategy that can effectively regulate power output levels and battery state of charge (SOC) [1]. The complete analysis of smart grid is incorporating extensive information and communication infrastructure. Minimize the long-term time-average expected electricity cost and consider the impact of storage capacity. The algorithm approaches to the optimal management of real time price [2]. The mainly percentage of an wind energy in a generation will ultimately be limited by its intermittency and uncertainty as a source of power systems applications and its performance is compared with that of an alternate scheduling approach. Thus the results demonstrate that the proposed algorithm requires a lower storage rating due to its ability to better coordinate operation of the two devices [3]. The basic strategy of power smoothing generation systems and power flow variations has occurred. The sensorless based vector control induction machine driving a flywheel, the tracking algorithm helps to detect the speed of the motor [4].

An electric double layer capacitor (EDLC) with power-electronics devices is useful for the compensation of fluctuating power since

one is capable of controlling the power simultaneously [5]. To increasing the penetrations, especially its intermittency, partly under predictability and variability of wind power can put the operation of the power system into risk. Electrical energy storage is one of the most promising solutions to the challenges related to wind integration [6]. The generated power from renewable energies is always fluctuating Energy storage system is indispensable to compensate these fluctuating components. Energy capacitor system (ECaSS) connected an electric double layer capacitor (EDLC) with power-electronics devices is useful for the compensation of fluctuating power. The control system for the active and reactive power control of CS-ECS is to verify the effectiveness of the system [7].

A severe network disturbance occurs in the power System, the energy capacitor system (ECS) composed of power electronic devices and electric double layer capacitor (EDLC) is the control scheme of ECS is based on a sinusoidal PWM voltage source converter (VSC) and fuzzy logic controlled dc - dc buck/boost converter using insulated gate bipolar transistors (IGBT) [8]. The variable-speed wind turbine driving a permanent-magnet synchronous generator is considered to be connected to the ac network through a fully controlled frequency converter. a suitable and economical topology of ECS composed of a current controlled voltage-source inverter, dc to dc Buck / Boost converter, and an electric double layer capacitor bank is presented [9].

II. PROPOSED SES METHODS

The Proposed Segmented Energy Storage can provide the Fig 2.1. To improves the power quality of renewable-energy hybrid power generation systems with using the flexible energy management systems. There are several control strategies and configurations methods for SES energy storage systems is used, such as energy storage battery system, superconducting magnetic energy system (SMES), a flywheel

energy system (FES), an energy capacitor system (ECS), and a fuel cell/electrolyzes hybrid system have been proposed to smooth wind power fluctuation or enhance power quality.

The energy storage systems recently utilized for a multiple applications, such as frequency regulations, peak shaving and uninterruptable power resources.

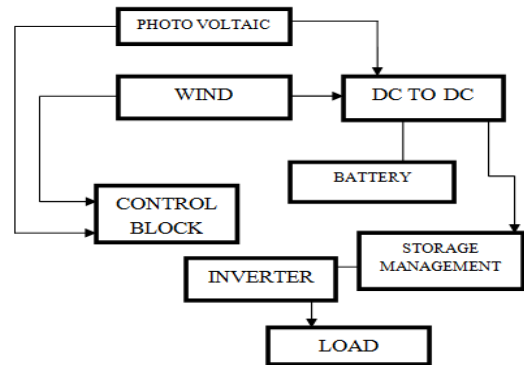


Fig 2.1 Functional block diagram

More specifically, Wind/PV/SES hybrid power generation system along with a state of charge (SOC)-based smoothing control strategy was utilized to instantaneously smoothen WP and PV power variation. To modified and accomplished the smoothed output data has adaptively and to making flexibility and use of feedback adjustments of battery SOC in real-time.

A. DC to DC Converter

DC to DC converters are important in portable electronic devices such as an electronic device often contain several sub circuits, its own voltage level requirements it is totally differ from the battery power supply to the external power supply. Additionally when the battery power is connected it automatically switched to the DC to DC converter, it offers to the method of an increasing the voltage level. The DC to DC converter works for to increase the voltage level.

B. Inverter

An inverter converts the variable direct current to an AC current. The converter section produces the output it receives the PV panel input voltage. The converter has to improve the voltage level is a direct current. At the power has been improved or converted to an alternating current it connects to an inverter circuit. It changes only DC to AC. The frequency alternating current can be fed into a commercial electrical grid or used by a local off grid electrical network. It is a critical component in a PV panel system, allowing the use of a general AC powered equipment. Solar inverter use maximum power point tracking (MPPT) to get the maximum power from the Photovoltaic array. Many solar inverters are designed to connect a utility grid and will not operate when they do not detect the grid.

C. Control and Storage Management

State-of-charge (SOC) measures the energy left in a battery, it is critical for managing batteries. To developing efficient SOC algorithms remains a challenging task. Using a PV panel or array of panels without a controller that can perform Maximum Power Point Tracking (MPPT) will often result in wasted power. This ultimately results in the need to install more panels for the same power requirement.

III. METHODOOGY

The circuit diagram Fig 3.1 shows that to connect the all sources with the help of ARM controller. The input source will taken to solar/wind or battery respectively, in the circuit diode D1 performs that function of a solar charger, it helps to improve the voltage power. The DC to DC converters is used to regulates the output voltage, the input source has directly connected to the battery charger and the source will passed to the coupled of inductor.

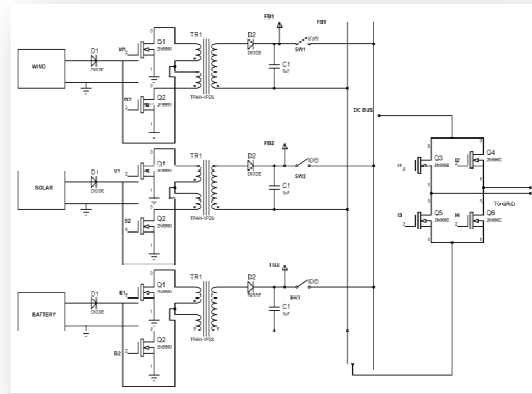


Fig 3.1 Circuit Diagram

While induced the power supply the inductor performs to the converter function. The coupled inductors are used. The positive supply will be connected to MOSFET named as Q1&Q2. The main purpose of MOSFET is used to amplifying the control signals. The primary circuits of the positive supply from solar power and are connected to couple inductor. The positive power supply from Battery power and is connected to couple inductor. The positive supply will be connected to MOSFET named as Q1 & Q2.

The secondary methods of rectifier mainly to converts the Alternative current (DC) to Direct current (AC), the feedback of wind (FB1), Solar (FB2), & Battery (FB3) is connected to the arm processor as an input and its shown in figure 3.1. Then the Dc bus the input from the three converters that DC bus output is given as input to inverters then the Dc supply is converted to AC supply by the help of H-Bridge inverter. It is used to convert the Direct current (DC) to Alternative current (AC).Then the inverter supply is given to the load.

A. Wind Energy

The wind energy is the best renewable energy resources in the country. It does not require the water, and current. An ideal situation of local wind is an area where land and water meet.



Fig 3.2 Wind Farm

The Wind speed is important to help to convert mechanical energy to electrical energy produce the electrical power. The wind speed can be measured using a wind gauge or anemometer. This type of anemometer is a device with three arms that spin on top of the shaft. The harder the wind blows, the faster the shaft spins. The controller device count the number spins rotates in an hour. It will be a display the using a LCD Monitor.

B. Solar Energy

Solar energy is the radiant energy it is produced by the sun. Every day the sun radiates the power, it produces the enormous amount of energy. The sun light has observed the PV panels. The light energy has converter to electrical energy.



Fig 3.3 Monolithic solar panels

Mono crystalline solar panels are the most efficient and expensive solar panels. These solar crystalline cells use very pure silicon and involve a complicated crystal growth process. Long silicon rods are produced which is cut into slices of 0.2 to 0.4 mm thick discs or wafers then it will processed into individual cells that are wired together in the solar panel.

IV. SIMULATION RESULTS

The simulation analyses were performed with a wind/PV/SES hybrid power system model. The model integrated with 3 - MW WPGS, 1.26 - MW PVGS, and 1 - MW SES. The SES was connected with the WPGS and PVGS to a utility-grid power system at a common coupling point, as shown in Fig 4.1. To verify the effectiveness of the proposed control strategy, a 10%–90% range of battery. The SOC was set, which of course was modifiable according to the SES control requirements. A simulation test considering the following three cases was conducted with MATLAB/SIMULINK software as Shown in fig 4.1

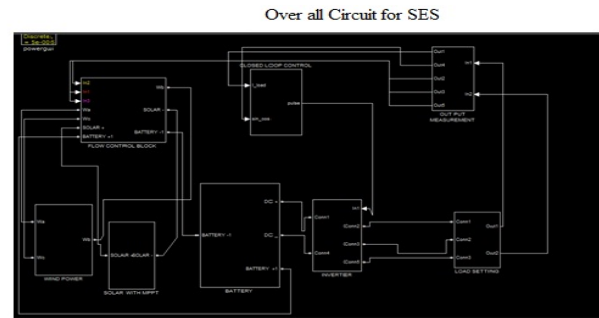


Fig 4.1 Overall Circuits for SES

The Generic battery block represents a simple battery model. The battery block implements a generic dynamic model parameterized to represents most popular types of rechargeable batteries. The first section represents the exponential voltage drop when the battery is charged, depending upon the battery type, this area is more or less wide and the section represents the charge that can be extracted from the battery until the voltage drops below the battery nominal voltage and the section represents the total discharge of the battery.

A. Solar Module

Solar MPPT is a device used to track the maximum power point of solar cell with the help of buck boost converter. This circuit is used to resistive the load solar panel is also simulated that is shown in fig 4.5. In order to maximize the use of solar energy the power generation system

which includes modeling of PV systems and maximum power point tracking (MPPT) methods for PV arrays that is shown in fig 4.4. Using the software Matlab a model of the solar power generation system with MPPT control based on fixed step perturbation and observation method has been obtained. Using this embedded Matlab function module, the core function of MPPT is achieved. The MPPT control is realized by means of MATLAB simulation.

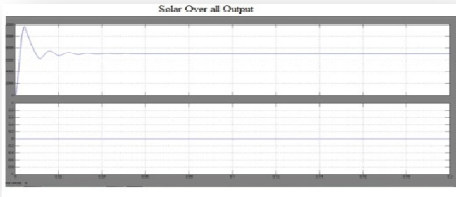


Fig 4.5 Over all output (Solar)

It is the purpose of the MPPT system to sample the output of the cells and apply the proper resistance (load) to obtain maximum power for any given environmental conditions. The MPPT devices are typically integrated in to an electric power conversion system that provides voltage or current conversion system filtering and regulations for driving various loads including power grids, motors and batteries.

B. Wind Module

It includes a three dimensional mechanical structure model of the tower, nozzle, and blades modeled in Sim Mechanics, hydraulic pitch actuators, electrical grid model. There are number of supporting models included that show how to develop each of the systems separately and integrate them in to the overall model. For the each system contains for that level of fidelity. It can be varying to the design. For system as complex as a wind turbine that ability to simulate the physical systems (mechanical, electrical, hydraulic, etc.) and control systems in a single environment is crucial to the development process, design at the system level, and to predicts, optimize overall

system performance without relying only on hardware prototypes.

Effectively managing the operation and management of wind farm asserts is critical to ensure economically efficient operation and quality of supply. In SES wind warm due to produce the output power 12Volts and 10 Watts and 1Amps power respectively that shown in fig 4.7.

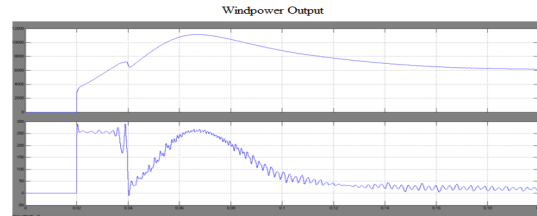


Fig 4.7 Wind farm output

Wind farm system integrators and operators can use modeling and operators can use modeling and simulation to investigate reactive power management of the available asserts on a wind farm. The goal of reactive power management is to regulate voltage at the grid point of connection reduce voltage flicker and manage the available reactive power capacity.

C. Flow Control Block

In a control flow graph each node in the graph represents a basic block, i.e. a straight line peace of code without any jumps or jump targets. It starts a block and jump end a block. Directed edges are used to represent jumps in the control flow. There are in a most presentation to specially designated blocks: the entry block, through which control centers in to the flow graph, and the exit block through which all control flow leaves. Because of its construction design has been designed with a using design procedure.

D. Closed Loop Control Module

One way in which we can accurately control the process is by monitoring its output and “feeding” some of its back to compare the actual output with the desired output. The measure of the output is called the “feed back Signal” and the type of control system which uses feedback signal to control itself is called a closed loop system that shown in fig 5.1.

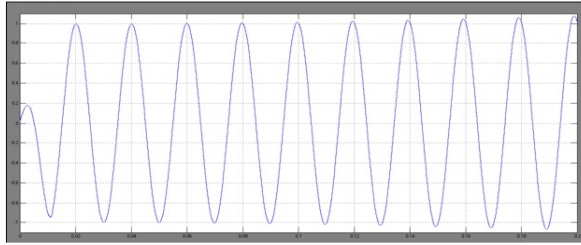


Fig 5.1 Feed back

A closed loop control system also known as a feedback control system is a control system which uses the concept of an open loop system as its forward path but has one or more feedback loops or path between its output and its input. The reference to “feedback” simply means that some portion of the output is returned “back” to the input to form part of the systems excitations that shown in fig 5.2.

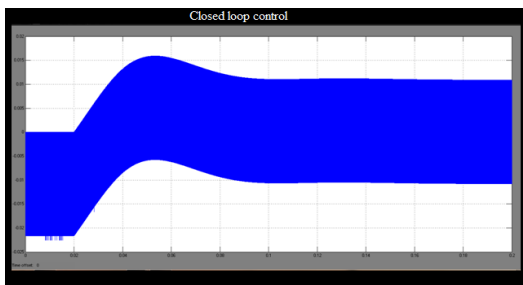


Fig 5.2 closed loop system

Closed loop systems are designed to automatically achieve and maintain the desired output condition by comparing it with the actual conditions. It does this a generating an error signal which is the difference between the output and the reference input. In other method a closed loop system is a fully automatic control systems in which its control action being dependent on the output in some way.

V. OUTPUT MEASUREMENT

It compares plots the simulated response of a dynamic system model, super imposed over validation data for comparison. The plot also been displayed the normalized RMS measure of the goodness of the fit that shown in fig 8.6. The data must be a frequency model then data must be a frequency response model too. Data can represent either time or frequency domain data when compare with linear models.

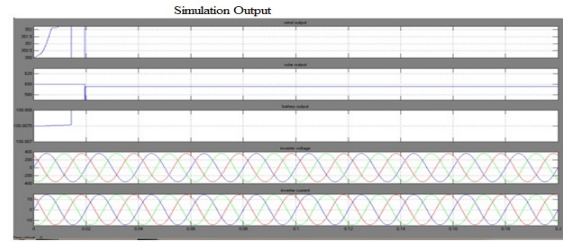


Fig 6.1 Simulation SES Output

Thus the Fig 6.1 Simulation SES output shows the output voltage and frequency and overall power handlings depend on the design of the specific device or circuitry. The inverter doesn't produce any power is provided by the Dc Source. Static inverters do not use moving parts in the conversion process. For that consumer portable device allows the user and contain a set of batteries in the device to produce the AC supply, it used for the electrical applications such as Lights, Computers and etc.

VII CONCLUSION

The PV and wind power generation is their unstable power output, which can impact negatively on utility and micro grid operations. By means of solving this problem is to integrate PVGS and WPGS with a SES. For such hybrid generation systems, control strategies for efficient power dispatch need to be developed. Therefore, in this paper, a novel SOC-based control strategy for smoothing the output fluctuation of a WP and PV hybrid generation system has been proposed. Additionally, Simulation results demonstrate that the proposed control strategy can manage SES power and SOC within a specified target region while smoothing PVGS and WPGS outputs. Another significant issue is the means by which an appropriate battery capacity for this application is to be determined.

The power control strategies for large scale renewable hybrid power systems taking into account the optimum capacity of SES and battery aging will be discussed in the near future combined with smoothing control application of wind and PV power generations. Simulation is done with the help of MATLAB using SES to improve the SOC in PV/Wind energy system.

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