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IMPLEMENTATION OF MULTI-INPUT SEPIC CONVERTER FOR HYBRID RENEWABLE ENERGY SUORCES

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Abstract: The Renewable energy sources have become a popular alternative electrical energy source where power generation in conventional ways is not practical. In the last few years the photovoltaic and wind power generation have been increased significantly. In this study, we proposed a hybrid energy system which combines both solar panel and wind turbine generator as an alternative for conventional source of electrical energy like thermal and hydro power generation.A simple control technique which is also cost effective has been proposed to track the operating point at which maximum power can be coerced from the PV system and wind turbine generator system under continuously changing environmental conditions. The entire hybrid system is described given along with comprehensive simulation results that discover the feasibility of the system.

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INTRODUCTION

Recent developments and trends in the electric power consumption indicate an increasing use of renewable energy. Virtually all regions of the world have renewable resources of one type or another. By this point of view studies on renewable energies focuses more and more attention.Solar energy and wind energy are the two renewable energy sources most common in use.Wind energy has become the least expensive renewable energy technology in existence and has peaked the interest of scientists and educators over the world. Photovoltaic cells convert the energy from sunlight into DC electricity. PVs offer added advantages over other renewable energy sources in that they give off no noise and require practically no maintenance. Hybridizing solar and wind power sources provide a realistic form of power generation.Many studies have been carried out on the use of renewable energy sources for power generationand many projects were presented earlier. The wind and solar energy systems are highly unreliable due to their unpredictable nature. In a PV panel was incorporated with a diesel electric power system to analyze the reduction in the fuel consumed. It was seen that the incorporation of an additional renewable source can further reduce the fuel consumption. When a source is unavailable or insufficient in meeting the load demands, the other energy source can compensate for the difference. Several hybrid wind/PV power systems with Maximum Power Point Tracking (MPPT) control have been proposed earlier

They used a separate DC/DC buck and buck- boost converter connected in fusion in the rectifier stage to perform the MPPT control for each of the renewable energy power sources. These systems have a problem that, due to the environmental factors influencing the wind turbine generator, high frequency current harmonics are injected into it. Buck and buck-boost converters do not have the capability to eliminate these harmonics. So the system requires passive input filters to remove it, making the system more bulky and expensive.

In this project, a new converter topology for hybridizing the wind and solar energy sources has been proposed. In this topology, both wind and solar energy sources are incorporated together using a combination of two modified SEPIC converters, so that if one of them is unavailable, then the other source can compensate for it. The boost converter is the usual structure utilized in high-power-factor (HPF) rectifiers in order to improve power factor (PF) and to reduce the total current harmonic distortion (THD). However, for universal input voltage application, the efficiency can be reduced mainly in the lowest input voltage and the worst operation condition must be considered in the power converter design procedure .The improvement of the efficiency at lower line voltage is important because the thermal design and heat sinks size are defined considering the worst operation point. Many works were developed in order to improve the operation characteristics of the power converter utilized in HPF universal input rectifiers

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the output voltage must be higher than the double of the maximum input voltage. A modification in the multiphase boost voltage doublers was used for a universal input HPF rectifier, in order to obtain high static gain at the lower input voltage with the same DC output voltage level of a classical boost converter. The integration of a voltage multiplier cell with a classical SEPIC converter is proposed in this work in order to obtain a high step-up static gain operating with low input voltage and a low step-up static gain for the high input voltage operation. The operation characteristics obtained with this modification makes the proposed structure an interesting alternative for the universal input HPF rectifier or wide input voltage range applications, operating with high efficiency. The proposed converter operates with a switch voltage lower than the output voltage and with an input current ripple lower than the classical boost converter. The power circuit of the proposed converter can be integrated with a simple regenerative snubber, obtaining soft-switching commutation and increasing the efficiency.

NEED FOR SOLAR ENERGY

Solar Panels are a form of active solar power, a term that describes how solar panels make use of the sun's energy: solar panels harvest sunlight and actively convert it to electricity. Solar Cells, or photovoltaic cells, are arranged in a grid-like pattern on the surface of the solar panel. Solar panels are typically constructed with crystalline silicon, which is used in other industries (such as the microprocessor industry), and the more expensive gallium arsenide, which is produced exclusively for use in photovoltaic (solar) cells.

Solar panels collect solar radiation from the sun and actively convert that energy to electricity. Solar panels are comprised of several individual solar cells. These solar cells function similarly to large semiconductors and utilize a large-area p-n junction diode. When the solar cells are exposed to sunlight, the p-n junction diodes convert the energy from sunlight into usable electrical energy. The energy generated from photons striking the surface of the solar panel allows electrons to be knocked out of their orbits and released, and electric fields in the solar cells pull these free electrons in a directional current, from which metal contacts in the solar cell can generate electricity. The more solar cells in a solar panel and the higher the quality of the solar cells, the more total electrical output the solar panel can produce. The conversion of sunlight to usable electrical energy has been dubbed the Photovoltaic Effect.

EXISTING SYSTEM

The renewable energy resources are naturally available and environmentally pollution less sources. A hybrid energy system is the combination of two or more very good naturally optional renewable energy sources. These hybrid energy resources are becoming easily available in remote areas. In hybrid distribution generation systems individual converters are used for each source. EPIC converter is used for Maximum power point tracking (MPPT) from PV panel and boost converter from PMSG in .CUK-SEPIC converter will filter out high frequency harmonics and perturb and observe algorithm for MPPT. High efficiency buck type DC-DC converter and a microcontroller based control unit running the MPPT, give high reliability, lower complexity, less mechanical stress of the WG. To reduce harmonics LCL filter is provided at the front end rectifier. Without using additional filters, to reduce high frequency harmonics in the wind/solar hybrid system.

PROPOSEDSYSTEM

A hybrid renewable system based on solar and fuel cell energy system with SEPIC converter fed single phase three level inverter has been implemented. The generated voltages are filtered and boosted by Single Ended Primary Inductor converter. The SEPIC converter provides constant DC voltage to the single phase three level inverter. The fuzzy logic control based maximum power point tracking algorithm has been used to extract the maximum power from the hybrid energy system. The PI controller makes the inverter output voltage equal to the grid voltage.This system has lower operating cost and finds applications in remote area power generation, constant speed and variable speed energy conversion systems and rural electrification. MATLAB/ SIMULINK software is used to model the PV panel, fuel cell, DC-DC converters and the proposed hybrid system. The inverter output voltage THD is 2.95%.

ARDUINO

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter. Revision 2 of the Uno board

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has a resistor pulling the 8U2 HWB line to ground, making it easier to put into DFU mode. Revision 3 of the board has the following new features:

1.0 pinout: added SDA and SCL pins that are near to the AREF pin and two other new pins placed near to the RESET pin, the IOREF that allow the shields to adapt to the voltage provided from the board. In future, shields will be compatible both with the board that use the AVR, which operate with 5V and with the Arduino Due that operate with 3.3V. The second one is a not connected pin, that is reserved for future purposes.

- Stronger RESET circuit.
- Atmega 16U2 replace the 8U2.

"Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform; for a comparison with previous versions, see the index of Arduino boards.

VOLTAGE REGULATOR

A voltage regulator is an electronic circuit that provides a stable DC voltage independent of the load current, temperature and AC line voltage variations. A voltage regulator may use a simple feed-forward design or may include negative feedback. It may use an electromechanical mechanism, or electronic components. Depending on the design, it may be used to regulate one or more AC or DC voltages.

Electronic voltage regulators are found in devices such as computer power supplies where they stabilize the DC voltages used by the processor and other elements. In automobile alternators and central power station generator plants, voltage regulators control the output of the plant. In an electric power distribution system, voltage regulators may be installed at a substation or along distribution lines so that all customers receive steady voltage independent of how much power is drawn from the line.

The circuit consists of following four parts.

- Reference voltage circuit
- Error amplifier
- Series pass transistor
- Feedback network

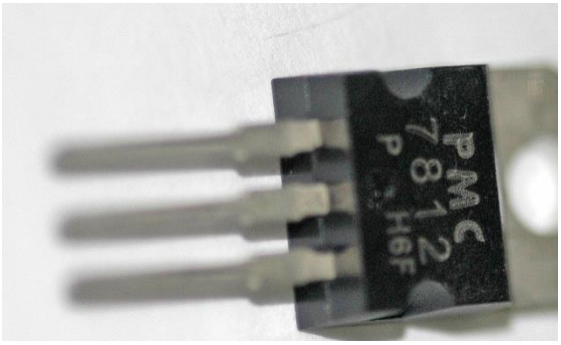

Figure2 (Circuit Diagram)

WORKING OF PRINCIPLE

To extract the maximum power from the solar array and wind energy, and to track the changes due to environment, maximum power point tracking should be implemented. The hill climbing mppt method involves moving the operating voltage by one step and then examining the change in generated power. If the power increases, the operating point moves in the same direction; otherwise it moves in the opposite direction. The wind power system design must optimize the annual energy capture at a given site. The only operating mode for extracting the maximum energy is to vary the turbine speed with varying wind speed such that at all times the TSR is continuously equal to that required for the maximum power coefficient. The power generated from a given PV module mainly depends on solar irradiance and temperature for a system without MPPT, the voltage will quickly collapse to zero. A system with MPPT avoids the voltage collapse by keeping the operating point near the Maximum Power Point. The advantages of MPPT algorithm are robustness and the easy to implement. The three level inverter will convert the DC voltage into AC voltage.

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CONCLUSION

Renewable energy sources also called non-conventional type of energy are continuously replenished by natural processes. Hybrid systems are the right solution for a clean energy production. Hybridizing solar and wind power sources provide a realistic form of power generation. Here, a hybrid wind and solar energy system with a converter topology is proposed which makes use of two modified SEPIC converters in the design.This topology allows the two sources to supply the load separately depending on the availability of the energy sources.The output voltage obtained from the hybrid system is the sum of the inputs of the modified SEPIC converters. The separate converters are integrated in order to minimize the circuit components and to improve the circuit efficiency. This system has lower operating cost and finds applications in remote area power generation, constant speed and variable speed energy conversion systems and rural electrification.

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