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TIE INTERGRATION FOR EFFICIENT POWER MANAGEMENT BASED ON SOLAR.

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Abstract:
Today, solar energy is being used to power a diverse variety of commercial applications, including solar water heaters and pumps, as well as stand-alone solar-powered homes and buildings. Solar cells, which capture the massive quantity of energy emitted by the Sun, have the potential to be used to create electrical power. As a result, the demand for power in our country has hit an all-time high and is projected to continue to increase in the coming days. This project is mainly concerned with the conversion of excess solar energy into usable electricity in order to ease the issue of power shortage in the country in question. It is possible to convert solar energy into electricity and then connect it to the power grid in order to solve the issue of power shortage. It is possible to generate direct current voltage by using solar cells to gather solar energy, which is then utilised to generate direct current voltage. In order to convert this direct current voltage into alternating current voltage, an IGBT-based three phase six pulse inverter will be used. Filters are used to remove the higher order harmonics that are present in the output signal of the signal inverter, which might cause interference. With the help of a Phase Locked Loop (PLL) base control system, it is possible to sync the filtered alternating current voltage with the power grid power grid.

Keywords— Solar cells, Grid, Dc chopper, Phase Locked Loop.

INTRODUCTION

For this reason, and due to the fact that solar energy is such an important source of renewable energy, it is separated into two categories of technologies, which are distinguished by the manner in which they absorb, distribute, or convert solar energy into electricity. Although both passive and active solar technologies gather and distribute sunlight, active solar technologies transform the energy absorbed by the sun into electrical current. In the case of solar energy, active solar technologies such as photovoltaic systems, concentrated solar power, and solar water are examples of renewable sources of energy. Most of the energy generated on the globe is derived from solar energy, which is available in many forms. Passive solar architecture entails orienting a building toward the Sun, selecting materials with adequate thermal

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mass or light dispersion properties, and designing areas that circulate air in the surrounding environment to reduce energy use.

In the solar energy conversion field, photovoltaic (PV) devices are solar energy conversion devices that directly convert incoming solar radiation into electricity. In addition to completing this technique without causing any noise or pollution, it also makes them robust, trustworthy, and long-lasting in nature. Energy harvesting using photovoltaic (PV) technology is a simple and elegant method of capturing sunlight's radiant energy.

B. Grid Tie Systems (also known as grid tie systems) (also known as grid tie systems)

A grid-connected power system is a solar photovoltaic (PV) system that is connected to a utility grid and generates energy for the grid. All of the components of a grid-connected system are included: the solar panel, the power conditioning unit, electronic converters, and a grid synchronizer, among others. It also comes with a built-in battery for further portability. Larger business rooftops are not considered as such, although small residential roofs are. In addition to being connected to the utility grid, when everything is working well, it may generate a significant quantity of power. Because the solar power may be less than the normal demand, the client may be required to purchase energy from the utility company's grid. They have the capability of re-injecting excess energy back into the power system. A metre is permanently put in order to monitor the transfer of electricity, which is performed via the use of feed-forward. Most consumers' demands may be met by rooftop systems with capacities of less than 10 kilowatts that are connected to the grid, which can be found in the majority of cases. Depending on their agreements with their local grid energy provider, the customer is accountable for paying the difference between the cost of power used and the value of electricity generated. If the organisation generates more electricity than it consumes, a negative amount will be shown on the screen.

LITERATURE REVIEW

On-site solar power is provided by two different types of solar panels at this time. A fixed panel is one that is put at a convenient angle depending on the geographical location of the installation site and has a constant tilt angle. The amount of time spent irradiating, on the other hand, is just a little more than six hours every day on average. Revolving solar panels are the second kind of solar panel. They may be configured to either spin at a certain angle at a predetermined interval or to revolve at a predetermined angle and time. Continuous monitoring and pre-programmed procedures are both inefficient, which is a shame since they are effective in certain situations. A high torque is required by a motor working at a very low speed, which in turn requires a big current, which results in an increase in driving power for the vehicle. The system rotates at predetermined small angles while utilising the second strategy, regardless of

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whether or not the new position contributes to the creation of more energy. In actuality, it is feasible that the recovered energy will be completely absorbed by the driving mechanism, resulting in the reversal of the intended effect.

These two drawbacks have been addressed in this new technique, which is shown in the next section. The use of a microcontroller-based control mechanism in this system allows for the most efficient harvest of solar energy possible. To achieve this, a tracking system known as the PILOT and a rotating system for cells known as the PANEL are built, with the PILOT serving as the primary tracking system. First and foremost, the system is oriented toward the east, where it will stay until the sun rises in the east. When this happens, the PILOT's position in relation to the sun is maintained. This is performed by the use of a light-to-frequency converter (LTF) placed on a tiny electric motor. This converter makes certain that the PILOT is always pointed in the direction of the sun. In addition to light-dependent resistors (LDRs), the PILOT and PANEL are both equipped with light-dependent resistors (LDRs), with one on the PILOT and one on the PANEL. Instantaneously after the completion of each PILOT positioning manoeuvre, the comparison operation begins. Unless the voltage generated by the PILOT LDR is larger than the voltage induced by the PANEL LDR plus a predefined offset, the PANEL moves to a new location and the procedure is performed once more. As a consequence, the PANEL will only go to a new region if the latter creates more energy than the prior one throughout its journey. Towards the conclusion of each day, after the sun has gone down, the system returns to its starting position and waits for the beginning of the following day.

Methodology

Thus, it is conceivable to conclude that the proposed technique maximises solar energy extraction to the greatest extent possible. According to a comparative study, as compared to fixed panels, there is an increase in energy extraction of around 40%. It was discovered via the study process that the optimised system had a major advantage over the continually rotating panel. In actuality, it was revealed that the energy savings on the consumption side accounted for somewhat more than 20% of the overall savings in energy. In peak hours, when the most energy is used, the panel only rotates a few times, making it even more energy efficient in this respect (in the case in hand only three times). In addition, the system's genius lies in the fact that it can be implemented with a single small PILOT that consumes very little current, enabling it to direct thousands of panels with ease. The future of solar energy extraction appears to be extremely promising as a result of significant advances in cell design, which is on the verge of reaching 50 percent efficiency, combined with an optimal panel orientation, such as the one proposed here, and the resulting reduction in energy consumption, to name a few factors.

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It is necessary to transform a variable direct current produced by the solar array into a fixed direct current dependent on the solar irradiation received by the cell. The DC-DC chopper is used to convert the fluctuating DC output of the solar cell into a consistent DC quantity that can be utilised by the inverter to ensure that the device operates properly and for an extended period of time. Electronic devices that operate in the active (linear) mode are able to operate at higher power levels because linear regulators are transformed into switching regulators in this mode of operation. Because it requires a voltage or current divider in order to work, it is inefficient owing to the fact that it is limited to output voltages lower than the input voltage and has a poor power density due to the need of a low frequency line transformer, among other factors. It is feasible to get very high energy conversion efficiency by using switching regulators. Therefore, they make use of power electronic switches, which are only capable of switching between two states: on and off. The operational frequency of transformers, filter inductors, and capacitors will be larger than the maximum frequency, which will result in lighter components. Using power electronic semiconductor switches, switching regulators are capable of operating in both the on and the off modes. Electronic switches of the present age have the capability of operating at very high frequencies. The frequency of operation increases according to the size of the operating frequency. Furthermore, when the operating frequency of converters is raised, the dynamic features of the converters become more favourable as well.

A description of the functions of direct current to direct current converters is given below.

The following characteristics are shared by an alternating current to direct current converter.

• The duty cycle ratio is used to assess whether the input DC voltage should be increased or decreased.When faced with fluctuations in load and line variations, it is able to maintain a steady direct current output voltage.In order to lower the threshold voltage ripples on the direct current output voltage, the voltage ripples must be increased to a level that is below it.There is a physical barrier between the source of the input and the load created by this device.

Step-up or boost converter for use in step-up or boost applications

This circuit design includes the following components: an input voltage source (VS), a boost inductor (L), a controlled switch (S), a diode (D), a filter capacitor (C), and a load resistance (R). FIG. 3.1 depicts the circuit diagram of a boost converter, which is presented in the next section. When the switch S is activated at this moment, the current flowing through the boost inductor increases linearly, and the diode D is switched off at the same time. In response to deactivation of the switching device S, the energy stored by the inductor is released via the diode and into the circuit's output RC circuit.

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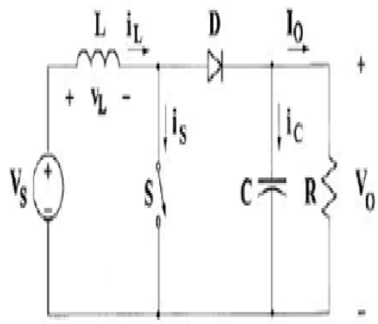

Fig 3.1 Step-up or Boost Converter

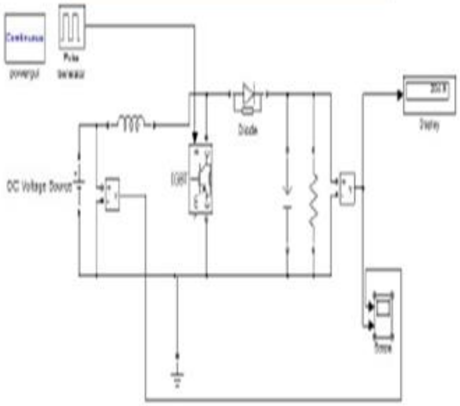

Fig 3.2 Matlab – Simulink circuit for Boost Converter

This particular chopper's function is to step up the constantly fluctuating DC input voltage to a fixed value at the output. The value of the output voltage generated by the switch is determined by the duty cycle of the pulse generator that controls the switch. The boost converter is used in lieu of the Buck-Boost converter, and it is the output voltage of the solar panel that is always less than the voltage required for the system to function properly. When the voltage on the source side is larger than the voltage on the load side, buck converters may be used. The solar panel's output, on the other hand, is never more than the quantity of energy needed by the load it is powering.

Boosters and multipliers that convert between different formats are examples of this.

The switch and pulse generator displayed in Fig. 3.2, as well as the boost converter shown in Fig. 3.2, are all simulated with the help of the Matlab programming language. In this case, a duty cycle of 50 percent may be used to calculate the output for the circuit under consideration. It is possible to calculate the values of the capacitor and inductor for a certain duty cycle, as well as the voltages at the input and output. Adjusting the output voltage of the power supply may be accomplished by adjusting the switching frequency and duty cycle of the power supply. The boost converter's output image is shown in FIG. 3.3, which is a depiction of the picture. As shown in Fig. 2, the configuration of the converter may be changed with the help of the pulse generator, which is displayed further down the page.

Results:

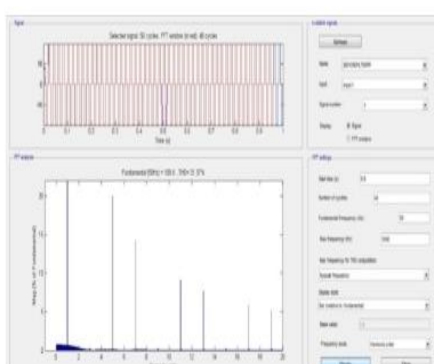

Fig 6.4(a) FFT analysis of the waveform before filter

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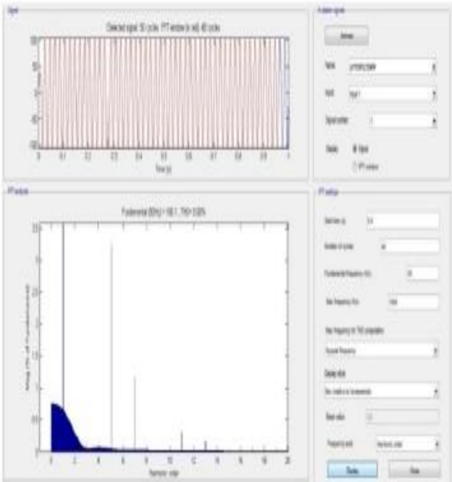

Fig 6.4(b) FFT analysis of the waveform after filter

The direct current (DC) voltage output from the chopper is converted to sinusoidal alternating current (AC) voltage with a power frequency of 50 Hz by means of a six-pulse inverter. When a second order low pass passive filter is used to filter out the harmonic content of the inverter's output, which is high owing to the inverter's high harmonic content, the harmonic content of the output is reduced. Figures 1 and 2 illustrate the FFT analysis of the waveform before and after the filter is applied, respectively. Figure 1 shows the waveform before the filter is applied. The output waveform of the filter is illustrated in Fig. 6.4, which has already been addressed earlier (a&b).

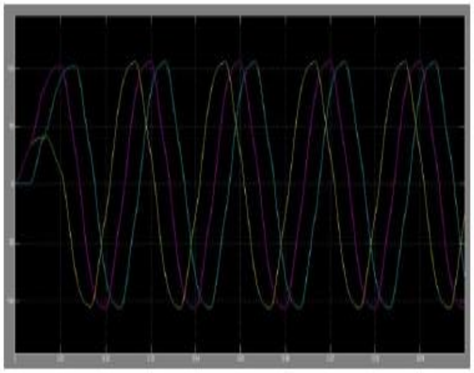

Fig 6.5(a) Output waveform before filter

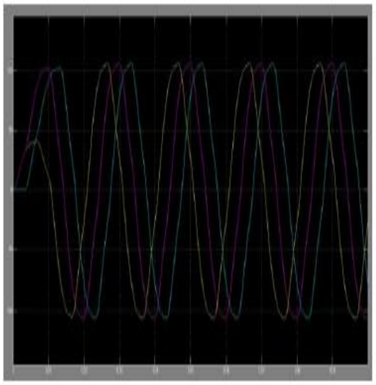

Fig 6.5(b) Output waveform after filter

It is necessary to monitor and synchronise the phases of signals in communications and signal processing systems, and a digital phase lock loop (DPLL) is used to accomplish this purpose. Along with the capacity to synchronise an inverter to the grid, the circuit has the capability of recovering synchronisation and altering the phase, amplitude, or distortion of grid power, among other things. It is possible to get DPLLs in a number of configurations and variants are available. DPLLs are often divided into two categories based on the nature of the sampling procedure: uniform DPLLs and non-uniform DPLLs. Non-

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uniform digital tan lock loops, as opposed to the uniform kind with a fixed time-delay unit, have quicker initialization times and need fewer circuit components, as shown in the time-delay digital tan lock loop (T-D-DTL) (TDTL). Once the filtering process is completed, the output of the inverter will be pure sinusoidal, and it will be sent into the grid. Before an inverter can be synchronised, the output of the inverter must be compared to the frequency, voltage, and phase of the power grid. It will be necessary to utilise a feedback loop to monitor and manage the synchronisation.

CONCLUSION

Simulations at varying levels of irradiance and load are carried out in Simulink to model the solar panel according to its requirements, and the characteristics produced from the simulations are compared with the characteristics of the provided solar panel. A boost DC chopper converts the output voltage of a solar panel into a continuous DC voltage generated by the chopper once it has been fed to it. The duty cycle of the DC chopper is controlled in such a way that it generates a constant output regardless of how much the solar output voltage fluctuates throughout the daytime. In an autonomous system that does not contain batteries, there is a resistive load to contend with.

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