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Effective Sine Wave Generation from Photovoltaic's Cell Using M Fitness Function

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Abstract: The world is using up all the resources to meet the demands of energy and it is quite expectable in the near future we run out of any naturally occurring ore/mineral/petroleum. As a result, renewable energy solution has achieved a great demand to save the natural resources and also to tackle thecrisis of energy. Solar energy rapidly gaining its popularity as an source of energy. But the efficiency of solar panel Is big factor. While the sun keeps followinga parabolic path throughout day, the panels which are in ourcountry are fixed to a or the of the house and hence, throughoutthe day, efficiency decreases significantly. In this researcher, we have constructed a axis tracker which can track the sun throughout the day to the maximum efficiency.

Key words: Solar energy, renewable energy, parabolic path, efficiency, significantly

INTRODUCTION

The ever-increasing reliance on electronic devices which utilize AC power highlights the problems associated with the unexpected loss of power from the electrical grid. In places where the electrical infrastructure is not well-developed, brown-outs can prove fatal when electronic medical instruments become unusable (Gannett, 2001). Therefore, there is a need for inexpensive and reliable pure-sine wave inverters for use with medical devices in the underdeveloped world. This report documents the development of one component of an uninterruptible power supply, the DC-to-AC inverter (Dixit *et al*., 2013).

Use of analog signal processing techniques, a prototype which efficiently and accurately emulates the pure-sine wave power present on the power grid was created (McKenzie, 2004). The three-level PWM system within this report is created with the possibility of a feedback-regulated system to be implemented in the future.

The power output is examined using M fitness function and the PWM system is implemented to adjust in accord to it (Oliva *et al*., 2004; Hassaine *et al*., 2007).

Literature review: Conventionally, there are two ways in which electrical power is transmitted. Direct Current (DC) comes from a source of constant voltage and is suited to short-range or device level transmission (Ross, 2009; Trubitsyn, 2010; Zadeh, 1965).

Alternating current (AC) power consists of a sinusoidal voltage source in which a continuously changing voltage (and current) can be used to employ magnetic components. Long distance electrical transmission favours AC power, since the voltage can be boosted easily with the use of transformers. By boosting the voltage, less current is needed to deliver a given amount of power to a load, reducing the resistive loss through conductors (Ekstrom, 2009).

The adoption of AC power has created a trend where most devices adapt AC power from an outlet into DC power for use by the device. However, AC power is not always available and the need for mobility and simplicity has given batteries an advantage in portable power. Thus, for portable AC power, inverters are needed. Inverters take a DC voltage from a battery or a solar panel as input and convert it into an AC voltage output.

There are three types of DC/AC inverters available on the market which are classified by their output type: square wave, modified-sine wave and pure sine wave. Off-the-shelf inverters are generally either square wave or modified-sine wave. These types of inverters are less expensive to make and the output, though delivering the same average voltage to a load is not appropriate to delicate electronic devices which rely on precise timing. Pure sine wave inverters offer more accuracy and less unused harmonic energy delivered to a load but they are more complex in design and more expensive. Pure sine wave inverters will power devices with more accuracy, less power loss and less heat generation.

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Pure sine wave inversion is accomplished by taking a DC voltage source and switching it across a load using an H-bridge. If this voltage needs to be boosted from the DC source, it can be accomplished either before the AC stage by using a DC-DC boost converter or after the AC stage by using a boost transformer. The inverted signal itself is composed of a Pulse-Width Modulated (PWM) signal which encodes a sine wave. The duty cycle of the output is changed such that the power transmitted is exactly that of a sine-wave. This output can be used as-is or alternatively, can be filtered easily into a pure sine wave. This report documents the design of a true sine wave inverter, focusing on the inversion of a DC high-voltage source. It therefore assumes the creation of a DC-DC boost phase.

Background research: Electrical power transmission is classified into two methods: alternating current and direct Current. Alternating current can be found in AC motor drives and long distance power transmission. The cyclic nature of alternating current enables the use of transformers which use magnetic principles to alter voltage levels. By stepping up an AC voltage, a large amount of power can be transferred over a long distance with less energy lost in heating up a conductor due to a lower current requirement, since P = IR. As such, AC power is more conventional than high voltage DC systems due to the ease of stepping up voltage for transmission and stepping voltage down to household outlet levels (Fig. 1).

DC voltage also has a place in powering devices. Wherever there is a changing electrical current, a changing magnetic field accompanies it. In a device-level electrical circuit, the magnetic variations introduced by AC current manifest themselves as electrical noise. The effects of this can range from audible line hum in an audio system to inaccurate measurements in an electronic instrument. Thus, it is commonplace for a device such as an MP3 a wall outlet AC output through voltage boosting and player to employ DC voltages that have been rectified and filtered from an AC wall outlet. An MP3 player also proves one other benefit of DC power transmission:

it can be done with a compact form factor. Without a need for transformers or switching circuitry, battery-powered MP3 players or any other portable device, can be made small enough to fit into a pocket.

However, there may come a time when household AC power is cut off due to a power outage. The multitude of devices that are designed around AC/DC power conversion (computers, for example) would then no longer

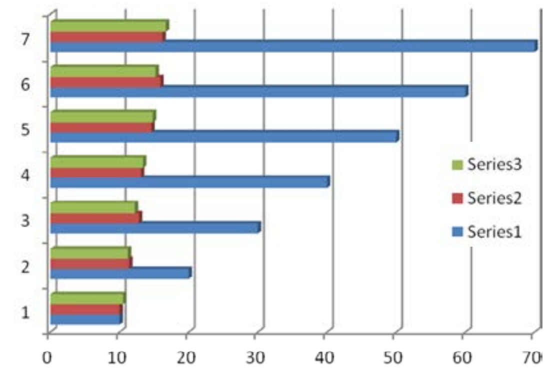

Fig. 1: Series 1 and analysis

be able to operate. One solution to this problem is an auxiliary AC power generator, like those powered by gasoline engines or DC/AC power inverters which use energy stored in batteries (a DC source) and emulate switching to create a changing voltage with the proper amplitude across a load. In practice, DC/AC conversion is done with topologies of varying precision. It can be as simple as applying voltages of equal amplitude in opposite directions across a load to generate a square wave. This method achieves the AC voltage requisite of a changing voltage across a load but this rough approximation has consequences discussed.

A more precise method of DC/AC conversion is the modified sine wave which introduces a dead time in a normal square wave output so that higher peak voltages can be used to produce the same average voltage as a sinusoidal wall-outlet output. This method produces fewer harmonics than square wave generation but it still is not quite the same as the AC power that comes from an AC outlet. The harmonics that are still present in a modified sine wave make modified sine-wave inverters unsuitable for use while electrical noise is a concern, such as in medical devices which monitor the vital signs of a human.

Pure sine wave DC/AC conversion will introduce the least amount of harmonics into an electrical device but are also the most expensive method. Since the AC sine wave must come from a DC source, switching must still take place. However, switching takes place with logic so that the energy delivered to a load approaches that of a pure sine wave. This means that extra components and design considerations are involved in the control circuitry of a pure sine wave inverter, driving up cost.

MATERIALS AND METHODS

Comparison of commercially inverters: Market research revealed some generalizations that can be made about

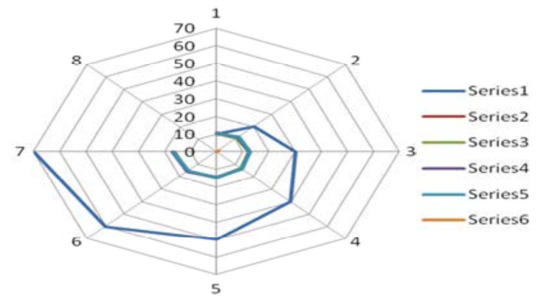

Fig. 2: Safe opreation of inverters

modified-sine and pure-Sine wave inverters. A comparison was performed between Duracell (by Xantrex) modified sine wave inverters and the PST series of pure sine wave inverter. For a more relevant comparison, each series of inverters had variants available in 300-W and 1000-ratings. In general, the inverters have larger dimensions, compared to their modified-sine counterparts and much higher cost. This is due to the added circuitry necessary to produce a pure sine wave. Note that all inverters operate from 12VDC input power. The commonalities that the inverters share hint at necessary features that any inverter should have. The inclusion of forced-air cooling, input protection and overload protection are needed for the safe operation of inverters (Fig. 2).

Analysis of different series: It should be noted that modified-sine wave inverters are not rated for Total Harmonic Distortion (THD). Rating a modified-sine wave inverter for harmonic distortion would be useless, for their intended use is not to reduce the harmonics introduced to devices. Their purpose is to provide affordable and portable AC power. A question of efficiency is brought up in the discussion of harmonics. The pure sine wave inverters are 5% less efficient but this rating is from the conversion of battery energy to modified-sine-wave output. This does not take into consideration the effect of harmonics on battery-to-device output efficiency. As stated by Samlex America, “the high frequency harmonic content in a modified sine wave produces enhanced radio interference, higher heating effect in motors/microwaves and produces overloading due to lowering of the impedance of low frequency filter capacitors/power factor improvement capacitors.” A pure-sine-wave inverter may be less efficient in terms of battery energy conversion but more of the output energy is used by the load.

Proposed system: Neural networks areuniversal approximates-meaning that for any function F and error E, there existssomeneural network (needing only a single hidden layer) that can approximate F with error less than E. Of course, finding that (those) network(s) is a completely different matter. And the best I can tell you is trial and error. Here’s the basic procedure:

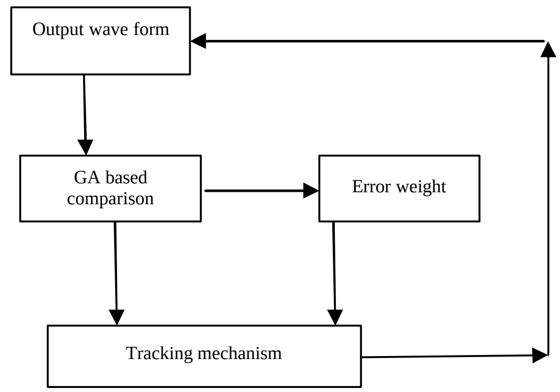

Fig. 3: Block diagram of feed backtracking

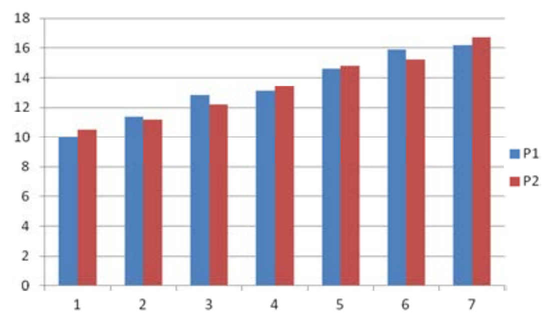

Fig. 4: P1, P2 vs. time

- Split your data into two parts: a training set (~2/3) and a testing set (~1/3)
- Train your network on all of the items in the training set
- Test (but don’t train) your networks on all the items in the testing set and record the average error
- Repeat steps 2 and 3 until you've reached a minimum testing error (this happens with “over fitting”when your network starts to get super good at the training data to the detriment of everything else) or until your overall error ceases to notably decrease (implying the network's as good as it's going to get)
- If the error at this point is acceptably low, you’re done. If not, your network isn’t complex enough to handle the function you’re training it for; add more hidden neurons and go back to the beginning (Fig. 3 and 4, Table 1)

Block diagram of feed back tracking: Sometimes changing your activation function can make a difference, too (just do not use linear as it negates the power of adding more layers).

Table 1: Diference in activation function

Time period	P1	P2	Fitness value	Actual value	Q
10	10.0	10.5	10.7	10.4	0
20	11.4	11.2	11.7	11.9	1
30	12.8	12.2	12.5	12.8	0
40	13.1	13.4	13.8	13.7	0
50	14.6	14.8	14.5	14.7	0
60	15.9	15.2	15.8	15.1	0
70	16.2	16.7	16.9	16.7	0

CONCLUSION

Solar panel's most important parameter is the amount of output power that it can efficiently deliver. And that is why power verses voltage curve is very crucial. The rated power of the panel that we used for the project is 3 watt. But we expected the power to be less than that because of the inefficiency of the cells of the panel and also because of some loses due to the internal resistance of the panel and the wiring. But since we need to know the maximum power output of our panel, we had to find the power voltage characteristic curve of our panel.

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