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Photovoltaic System for Pulse Charging of Battery Power Supply of Sensor Devices in Greenhouses

Svetoslav Ivanov, Yanka Ivanova and Seher Kadirova

Technical University of Sofia, Plovdiv branch, e-mail: etehsv@gmail.com

GOAL OF THE STUDY

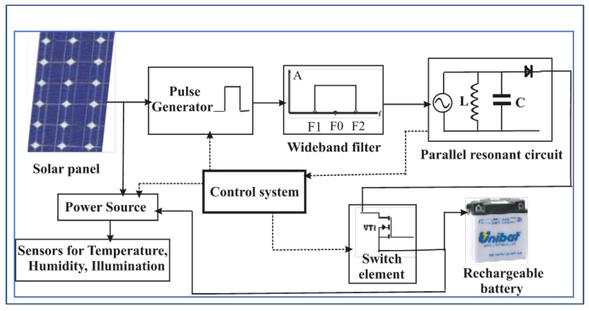
The purpose of this article is to be created a new method and scheme for pulsed charging of a low current consumption battery from the photovoltaic panel.

METHODOLOGY OF THE INVESTIGATION

The research was done in order to apply the method of resonant circuits to generate powerful current pulses to charge a battery.

MAIN RESULTS FROM THE STUDY

The designed principal scheme for the realization of the new method of pulse charging of the battery and power supply of the sensors is shown in Figure 2.



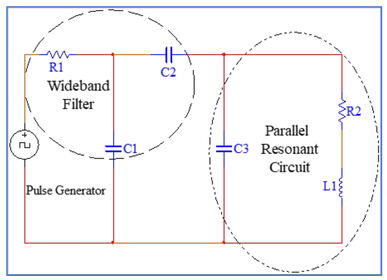


Fig. 4. Wideband filter and parallel resonant circuit

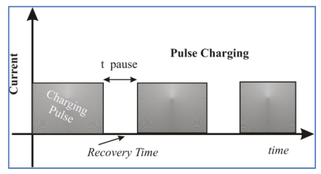


Fig.1. Pulse battery charging

The pulse generator powered by the photovoltaic panel sends pulses to the input of the wideband filter. The pulse generator generates rectangular pulses at a frequency of 1 kHz with a Duty Cycle D = 50% and with an amplitude value of 40V At the output of the filter, a sinusoidal voltage is obtained with a frequency equal to the resonant frequency of the parallel oscillating circuit.

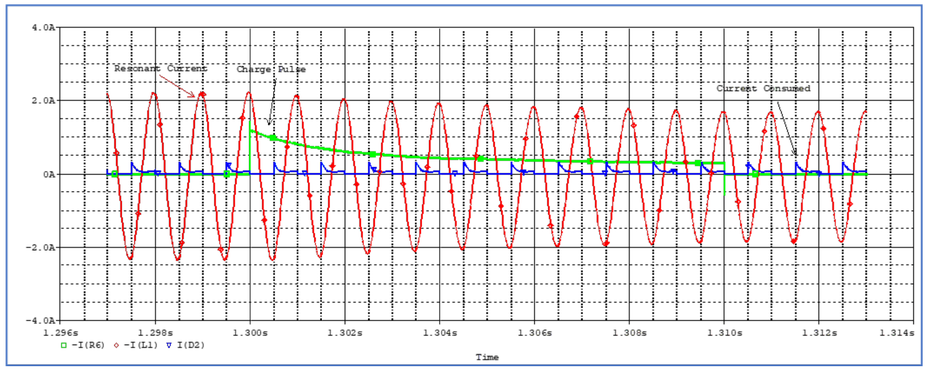


Fig.5. Oscillograms of the resonant current, the current consumed by the photovoltaic panel and the charging pulse for the rechargeable battery

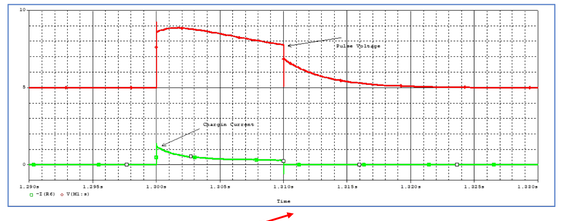
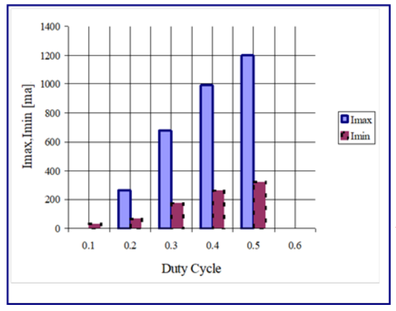


Fig.6. Shape of the pulse voltage and charging current of the pulses

The electrical power consumed by the pulse charger is nearly 8 times less than the maximum power generated by the photovoltaic panel. The current in the parallel resonant circuit reaches a value nearly 36 times greater than the average value of the consumed current from the band pass filter.



The realized and researched charger makes it possible to adjust the magnitude of the charge pulses current as shown in Figure 7. The adjustment can be accomplished by changing the Duty Cycle of the pulses from the generator feeding the belt filter controlled by the control system shown in Figure 2.

Fig.7. Regulation characteristic of the charger device

CONCLUSIONS

The realized and researched pulse charging scheme of a battery allows its inclusion in a closed system for automatic control of the charging process. The magnitude of the charging current can be adjusted by the Duty Cycle of the input pulses for the bandpass filter. Electrical power consumed by the scheme for pulse loading is 2.4W at maximum output power of the solar panel 20W. This ensures the reliable operation of the charger even with weak solar radiation.

ACKNOWLEDGMENT

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