

HYBRID SOLAR-WIND ENERGY SYSTEM WITH MPPT USING CUK-SEPIC FUSED CONVERTER

Dr.S.PRAKASH¹,A.GANESHVIJAY²,
¹Professor,²P.G. Scholar, Dept. of EEE,
BIST, BIHER, Bharath university,Chennai-73
prakash.eee@bharathuniv.ac.in

ABSTRACT - The proposed design has the Cuk and Sepic converters combined together which eliminate the need of additional input filters to filter out the high frequency harmonics. Maximum Power Point Tracking (MPPT) technique used is Modified Incremental conductance algorithm due to its high tracking accuracy and precise control under rapidly changing atmospheric conditions.

1. INTRODUCTION

Global warming and energy policies have become a hot topic on the international agenda in the last years[1-6]. Developed countries are trying to reduce their greenhouse gas emissions. For example, the EU has committed to reduce the emissions of greenhouse gas to at least 20% below 1990 levels and to produce no less than 20% of its energy consumption from renewable sources by 2020[7-11]. In this context, photovoltaic (PV) power generation

has an important role to play due to the fact that it is a green source[12-19]. The only emissions associated with PV power generation are those from the production of its components. After their installation they generate electricity from the solar irradiation without emitting greenhouse gases. In their lifetime, which is around 25 years, PV panels produce more energy than that for their manufacturing. Also they can be installed in places with no other use[20-26], such as roofs and deserts, or they can produce electricity for remote locations, where there is no electricity network. However, most of the PV power generation comes from grid-connected installations, where the power is fed in the electricity network. Due to the equipment required, PV power generation is more expensive than other resources[30-36].

Increasing the efficiency in PV plants so the power generated increases is a key aspect, as it will increase the incomes[37-42], reducing consequently the cost of the

power generated so it will approach the cost of the power produced from other sources. The efficiency of a PV plant is affected mainly by three factors: the efficiency of the PV panel (in commercial PV panels it is between 8-15%), the efficiency of the inverter (95-98 %) and the efficiency of the maximum power point tracking (MPPT) algorithm (which is over 98%). Improving the efficiency of the PV panel and the inverter is not easy as it depends on the technology available, it may require better components, which can increase drastically the cost of the installation [43-45].

It is very important to track the MPP accurately under all possible conditions so that the maximum available power is always obtained. In the past years numerous MPPT algorithms have been published. They differ in many aspects such as complexity, sensors required, cost or efficiency. However, it is pointless to use a more expensive or more complicated method if with a simpler and less expensive one similar results can be obtained. This is the reason why some of the proposed techniques are not used. Measuring the efficiency of MPPT algorithms has not been standardized until the European Standard EN 50530 was published at the end of May, 2010. It

specifies how to test the efficiency of MPPT methods both statically and dynamically. In any case, there are no publications comparing the results of the different MPPT algorithms under the conditions proposed in the standard.

The objective of this project is firstly to review different MPPT algorithms. Then the most popular, perturb and observe (P&O), incremental conductance (InCond) and fuzzy logic control (FLC) are analyzed in depth and tested according to the standard mentioned above. After that, improvements to the P&O and the InCond algorithms are suggested to succeed in the MPPT tracking under conditions of changing irradiance. To test the MPPT algorithms according to the irradiation profiles proposed in the standard, a simplified model was developed, because the simulation time required in some of the cases cannot be reached with the detailed switching model of a power converter in a normal desktop computer. The reason for that is that the computer runs out of memory after simulating only a few seconds with the complete model. Finally, the simplified model is verified by comparing its results with those obtained from a model containing a detailed model of an inverter.

1.1 SEPIC CONVERTER

The single-ended primary-inductor converter (SEPIC) is a type of DC/DC converter allowing the electrical potential (voltage) at its output to be greater than, less than, or equal to that at its input. The output of the SEPIC is controlled by the duty cycle of the control transistor.

A SEPIC is essentially a boost converter followed by a buck-boost converter, therefore it is similar to a traditional buck-boost converter, but has advantages of having non-inverted output (the output has the same voltage polarity as the input), using a series capacitor to couple energy from the input to the output (and thus can respond more gracefully to a short-circuit output), and being capable of true shutdown: when the switch is turned off, its output drops to 0 V, following a fairly hefty transient dump of charge.

SEPICs are useful in applications in which a battery voltage can be above and below that of the regulator's intended output. For example, a single lithium ion battery typically discharges from 4.2 volts to 3 volts; if other components require 3.3 volts, then the SEPIC would be effective.

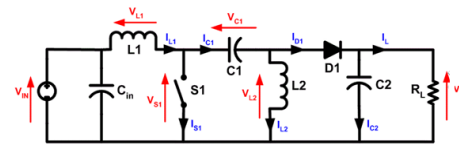


Fig 1. SEPIC converter

2. SIMULATION RESULTS

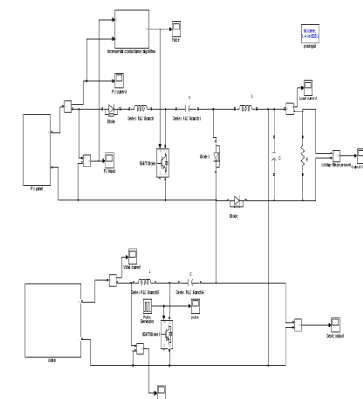


Fig 2. Conventional model

2.1 EXISTING MODEL OUTPUT

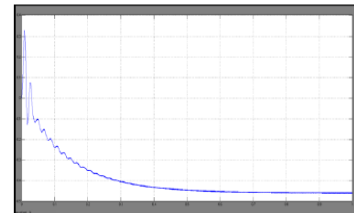


Figure 4.4 : PV Panel Output Voltage After Cuk Converter Operation

Fig 2.1 PV output after cuk operation

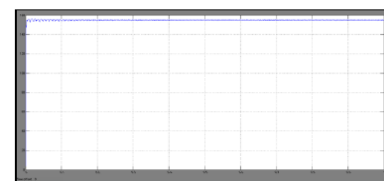


Figure 4.6 Wind Output To Sepic Converter

Fig 2.2. Wind output sepic converter

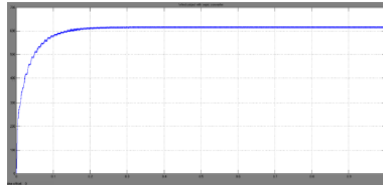


Figure 4.7: Wind Output After Sepic Converter Operation

Fig 2.3 Wind output after sepic converter

2.2 EXISTING MODEL OUTPUT

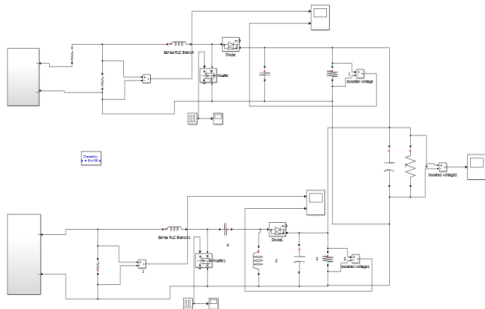


Fig 3. Proposed model

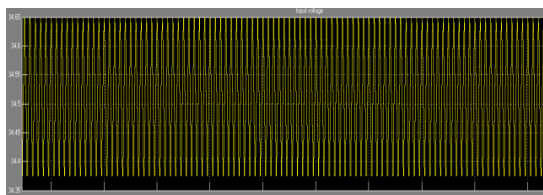


Fig 3.1 solar input voltage

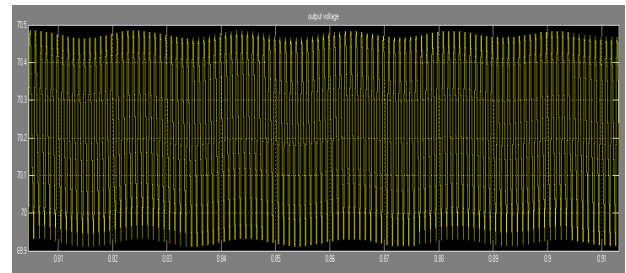


Fig 3.2 Cuk converter output voltage

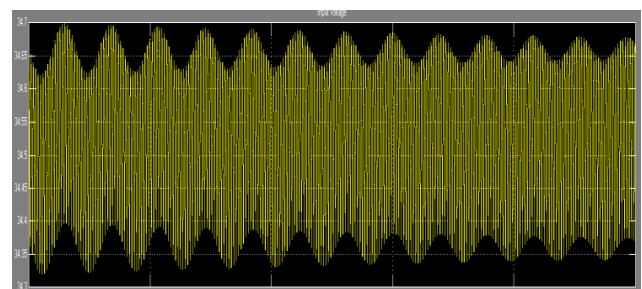


Fig 3.3 wind generator output voltage

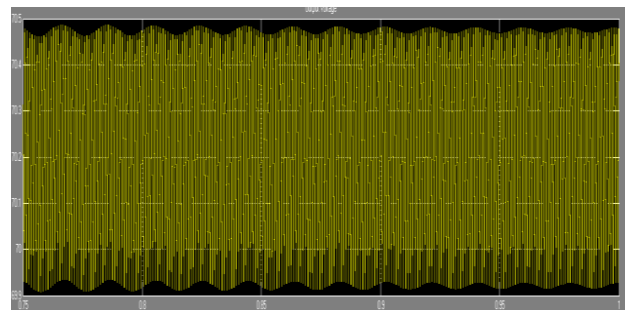


Fig 3.4 Sepic converter output voltage

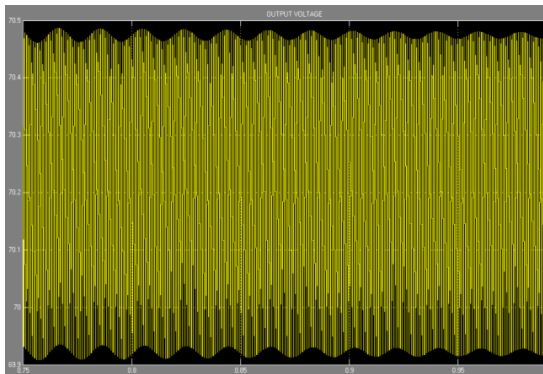


Fig 3.5 Hybrid voltage to load

3. CONCLUSION

In this paper a fused cuk-sepic converter stage for hybrid wind/solar energy systems has been presented. This topology makes continuous power generation possible in order to meet the load demand by allowing the two sources to supply the load either individually or simultaneously. The advantages of proposed converter are eliminating the need of additional input filters to filter out the high frequency harmonics, supports wide ranges of pv and wind input, low input current distortion, low conduction losses and improving the conversion efficiency using maximum power point tracking algorithm. Simulation results have been presented using matlab/simulink to verify the features of the proposed topology. This system has lower operating cost and finds applications

in remote area power generation, constant speed and variable speed energy conversion systems, aerospace industries, electric vehicles, communication equipment and rural electrification.

4. REFERENCES

1. Nimal, R.J.G.R., Hussain, J.H., Effect of deep cryogenic treatment on EN24 steel, International Journal of Pure and Applied Mathematics, V-116, I-17 Special Issue, PP-113-116, 2017
2. Parameswari, D., Khanaa, V., Deploying lampport clocks and linked lists, International Journal of Pharmacy and Technology, V-8, I-3, PP-17039-17044, 2016
3. Parameswari, D., Khanaa, V., Case for massive multiplayer online role-playing games, International Journal of Pharmacy and Technology, V-8, I-3, PP-17404-17409, 2016
4. Parameswari, D., Khanaa, V., Deconstructing model checking with hueddot, International Journal of Pharmacy and Technology, V-8, I-3, PP-17370-17375, 2016
5. Parameswari, D., Khanaa, V., The effect of self-learning epistemologies on theory, International Journal of Pharmacy and Technology, V-8, I-3, PP-17314-17320, 2016
6. Pavithra, J., Peter, M., Gowtham Aashirwad, K., A study on business process in IT and systems through extranet, International Journal of Pure and Applied Mathematics, V-116, I-19 Special Issue, PP-571-576, 2017

7. Pavithra, J., Ramamoorthy, R., Satyapira Das, S., A report on evaluating the effectiveness of working capital management in googolsoft technologies, Chennai, International Journal of Pure and Applied Mathematics, V-116, I-14 Special Issue, PP-129-132, 2017
8. Pavithra, J., Thooyamani, K.P., A cram on consumer behaviour on Mahindra two wheelers in Chennai, International Journal of Pure and Applied Mathematics, V-116, I-18 Special Issue, PP-55-57, 2017
9. Pavithra, J., Thooyamani, K.P., Dkhar, K., A study on the air freight customer satisfaction, International Journal of Pure and Applied Mathematics, V-116, I-14 Special Issue, PP-179-184, 2017
10. Pavithra, J., Thooyamani, K.P., Dkhar, K., A study on the working capital management of TVS credit services limited, International Journal of Pure and Applied Mathematics, V-116, I-14 Special Issue, PP-185-187, 2017
11. Pavithra, J., Thooyamani, K.P., Dkhar, K., A study on the analysis of financial performance with reference to Jeppiaar Cements Pvt Ltd, International Journal of Pure and Applied Mathematics, V-116, I-14 Special Issue, PP-189-194, 2017
12. Peter, M., Dayakar, P., Gupta, C., A study on employee motivation at Banalari World Cars Pvt Ltd Shillong, International Journal of Pure and Applied Mathematics, V-116, I-18 Special Issue, PP-291-294, 2017
13. Peter, M., Kausalya, R., A study on capital budgeting with reference to signware technologies, International Journal of Pure and Applied Mathematics, V-116, I-18 Special Issue, PP-71-74, 2017
14. Peter, M., Kausalya, R., Akash, R., A study on career development with reference to prem heera surgicals, International Journal of Pure and Applied Mathematics, V-116, I-14 Special Issue, PP-415-420, 2017
15. Peter, M., Kausalya, R., Mohanta, S., A study on awareness about the cost reduction and elimination of waste among employees in life line multispeciality hospital, International Journal of Pure and Applied Mathematics, V-116, I-14 Special Issue, PP-287-293, 2017
16. Peter, M., Srinivasan, V., Vigneshsa, A., A study on working capital management at deccan Finance Pvt Limited Chennai, International Journal of Pure and Applied Mathematics, V-116, I-14 Special Issue, PP-255-260, 2017
17. Peter, M., Thooyamani, K.P., Srinivasan, V., A study on performance of the commodity market based on technicalanalysis, International Journal of Pure and Applied Mathematics, V-116, I-18 Special Issue, PP-99-103, 2017
18. Philomina, S., Karthik, B., Wi-Fi energy meter implementation using embedded linux in ARM 9, Middle - East Journal of Scientific Research, V-20, I-12, PP-2434-2438, 2014
19. Philomina, S., Subbulakshmi, K., Efficient wireless message transfer system, International Journal of Pure and Applied Mathematics, V-116, I-20 Special Issue, PP-289-293, 2017
20. Philomina, S., Subbulakshmi, K., Ignition system for vechiles on the basis of GSM, International Journal

- of Pure and Applied Mathematics, V-116, I-20 Special Issue, PP-283-286, 2017
21. Philomina, S., Subbulakshmi, K., Avoidance of fire accident by wireless sensor network, International Journal of Pure and Applied Mathematics, V-116, I-20 Special Issue, PP-295-299, 2017
 22. Pothumani, S., Anuradha, C., Monitoring android mobiles in an industry, International Journal of Pure and Applied Mathematics, V-116, I-20 Special Issue, PP-537-540, 2017
 23. Pothumani, S., Anuradha, C., Decoy method on various environments - A survey, International Journal of Pure and Applied Mathematics, V-116, I-10 Special Issue, PP-197-199, 2017
 24. Pothumani, S., Anuradha, C., Priya, N., Study on apple iCloud, International Journal of Pure and Applied Mathematics, V-116, I-8 Special Issue, PP-389-391, 2017
 25. Pothumani, S., Hameed Hussain, J., A novel economic framework for cloud and grid computing, International Journal of Pure and Applied Mathematics, V-116, I-13 Special Issue, PP-5-8, 2017
 26. Pothumani, S., Hameed Hussain, J., A novel method to manage network requirements, International Journal of Pure and Applied Mathematics, V-116, I-13 Special Issue, PP-9-15, 2017
 27. Pradeep, R., Vikram, C.J., Naveenchandra, P., Experimental evaluation and finite element analysis of composite leaf spring for automotive vehicle, Middle - East Journal of Scientific Research, V-12, I-12, PP-1750-1753, 2012.
 28. Pradeep, R., Vikram, C.J., Naveenchandra, P., Experimental evaluation and finite element analysis of composite leaf spring for automotive vehicle, Middle - East Journal of Scientific Research, V-17, I-12, PP-1760-1763, 2013.
 29. Prakash, S., Jayalakshmi, V., Power quality improvement using matrix converter, International Journal of Pure and Applied Mathematics, V-116, I-19 Special Issue, PP-95-98, 2017
 30. Prakash, S., Jayalakshmi, V., Power quality analysis & power system study in high voltage systems, International Journal of Pure and Applied Mathematics, V-116, I-19 Special Issue, PP-47-52, 2017
 31. Prakash, S., Sherine, S., Control of BLDC motor powered electric vehicle using indirect vector control and sliding mode observer, International Journal of Pure and Applied Mathematics, V-116, I-19 Special Issue, PP-295-299, 2017
 32. Prakesh, S., Sherine, S., Forecasting methodologies of solar resource and PV power for smart grid energy management, International Journal of Pure and Applied Mathematics, V-116, I-18 Special Issue, PP-313-317, 2017
 33. Prasanna, D., Arulselvi, S., Decoupling smalltalk from rpcs in access points, International Journal of Pure and Applied Mathematics, V-116, I-16 Special Issue, PP-1-4, 2017
 34. Prasanna, D., Arulselvi, S., Exploring gigabit switches and journaling file systems, International Journal of Pure and Applied

- Mathematics, V-116, I-16 Special Issue, PP-13-17, 2017
35. Prasanna, D., Arulselvi, S., Collaborative configurations for wireless sensor networks systems, International Journal of Pure and Applied Mathematics, V-116, I-15 Special Issue, PP-577-581, 2017
 36. Priya, N., Anuradha, C., Kavitha, R., Li-Fi science transmission of knowledge by way of light, International Journal of Pure and Applied Mathematics, V-116, I-9 Special Issue, PP-285-290, 2017
 37. Priya, N., Pothumani, S., Kavitha, R., Merging of e-commerce and e-market-a novel approach, International Journal of Pure and Applied Mathematics, V-116, I-9 Special Issue, PP-313-316, 2017
 38. Raj, R.M., Karthik, B., Effective demining based on statistical modeling for detecting thermal infrared, International Journal of Pure and Applied Mathematics, V-116, I-20 Special Issue, PP-273-276, 2017
 39. Raj, R.M., Karthik, B., Energy sag mitigation for chopper, International Journal of Pure and Applied Mathematics, V-116, I-20 Special Issue, PP-267-270, 2017
 40. Raj, R.M., Karthik, B., Efficient survey in CDMA system on the basis of error revealing, International Journal of Pure and Applied Mathematics, V-116, I-20 Special Issue, PP-279-281, 2017
 41. Rajasulochana, P., Krishnamoorthy, P., Ramesh Babu, P., Datta, R., Innovative business modeling towards sustainable E-Health applications, International Journal of Pharmacy and Technology, V-4, I-4, PP-4898-4904, 2012
 42. Rama, A., Nalini, C., Shanthi, E., An iris based authentication system by eye localization, International Journal of Pharmacy and Technology, V-8, I-4, PP-23973-23980, 2016
 43. Rama, A., Nalini, C., Shanthi, E., Effective collaborative target tracking in wireless sensor networks, International Journal of Pharmacy and Technology, V-8, I-4, PP-23981-23986, 2016
 44. Ramamoorthy, R., Kanagasabai, V., Irshad Khan, S., Budget and budgetary control, International Journal of Pure and Applied Mathematics, V-116, I-20 Special Issue, PP-189-191, 2017
 45. Ramamoorthy, R., Kanagasabai, V., Jivandan, S., A study on training and development process at Vantec Logistics India Pvt Ltd, International Journal of Pure and Applied Mathematics, V-116, I-14 Special Issue, PP-201-207, 2017

