Ashish Raj, 2021, 9:4
ISSN (Online): 2348-4098
ISSN (Print): 2395-4752

# Highly Efficient Fly back Micro inverter for Photovoltaic Applications

**PG Scholar Ashish Raj, Asst. Prof. Abhishek Dubey, Asst. Prof. Pawan Kumar Shandilya**
Dept. of Electrical and Electronics
Bhopal institute of Technology and Science
Bhopal, MP, India

**Abstract- This paper presents a plan of exceptionally effective flyback microinverter for photovoltaic applications. Reenactment is finished utilizing MATLAB simulink programming. The past and present plan utilized for the photovoltaic applications. Subsequently reenacted results give huge improvement in present model execution than existing model execution.**

**Keywords:- Toxicosis, MCPA, MCPG; hypoglycaemia; acute hypoglycaemic encephalopathy.**

## I. INTRODUCTION

Power preparing frameworks will be a vital factor of future photovoltaic (PV) applications. They will assume a focal part in moving, to the heap and additionally to the framework, the electric power delivered by the high-efficiency PV cells of the future. To come up the assumptions identified with the utilization of sunlight based energy for creating electrical energy, such frameworks should guarantee high efficiency, seclusion, and, especially, high unwavering quality.

## II. PRESENT WORK

The main contribution of the present research work is as followings-

- The present highly Boost-Fly back/Fly back micro-inverter with non-isolated pseudo DC link, which consists of a highly BF/F converter and an unfolding stage.
- To design present model with the help of sub modules and implement using MATLAB 9.4 Software.
- To improve the parameters with the help of simulation values.
- To calculate parameters and compare from existing model.
- The highly BF/F converter is comprised of a decoupling capacitor Ci, a main power switch Q1, a resonant capacitor Cs, two power rectifier Diodes D1 and D2, two output filter capacitors C1 and C2, a coupled transformer T.
- The unfolding stage includes four switches S1, S2, S3 and S4 operated at line frequency, a filter capacitor Cf and a filter inductor Lf. If the switch Q2 is ON and Q3 is OFF, then the micro-inverter is in BF mode, otherwise, the micro-inverter is in F mode.

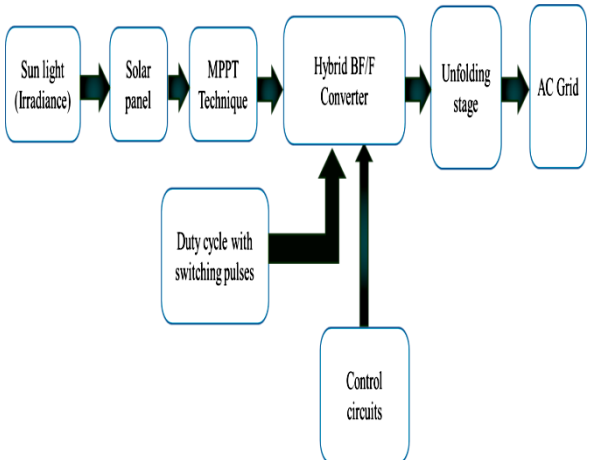


Fig 1. Flow Chart.

The description of flow chart is as followings sub modules-

- AC grid
- Hybrid BF/F Converter
- Pulse width modulation(PWM)
- Solar panel
- MPPT Technique

International Journal of Science, Engineering and Technology

An Open Access Journal

## III. RESULT DISCUSSION

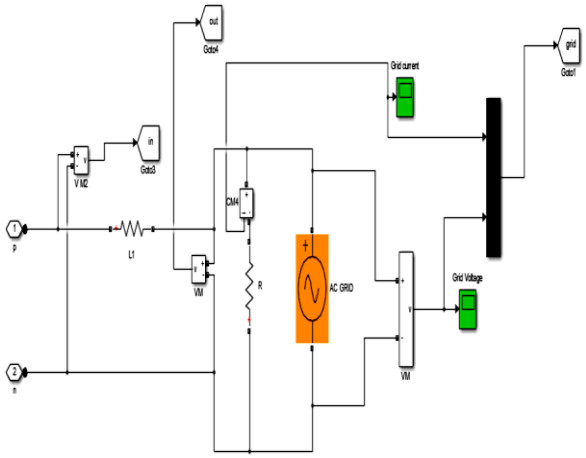


Fig 2. AC Grid.

Figure 2 is showing the AC grid of the current model. Electrical grid or power grid is defined as the organization which interconnects the age, transmission and conveyance unit. A lot of power is sent from the producing station to stack focus at higher voltage.

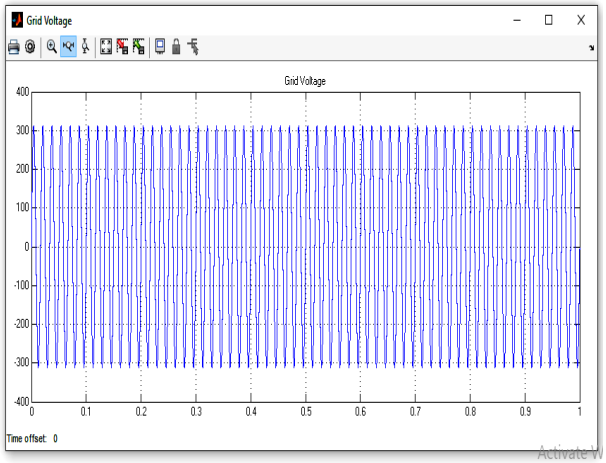


Fig 3. Grid Voltage.

Figure 3 is showing the value of grid voltage. It is generated from the overall microinverter system. The value of grid voltage is 320V.

Figure 4 is showing the value of grid current. It is generated from the overall microinverter system. The value of grid current is 9.5A.

Figure 5 is showing the MPPT control and the unfolding control. MPPT checks yield of PV module, looks at it to battery voltage at that point fixes what is the best power that PV module can create to charge the battery and converts it to the best voltage to get maximum current into battery. It can likewise supply power to a DC load, which is associated directly to the battery.

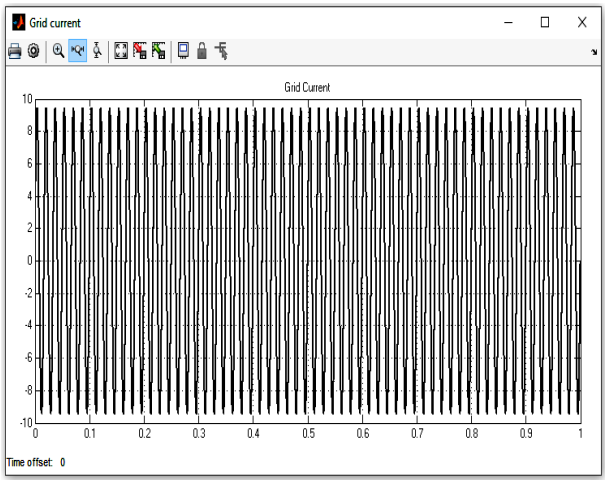


Fig 4. Grid Current.

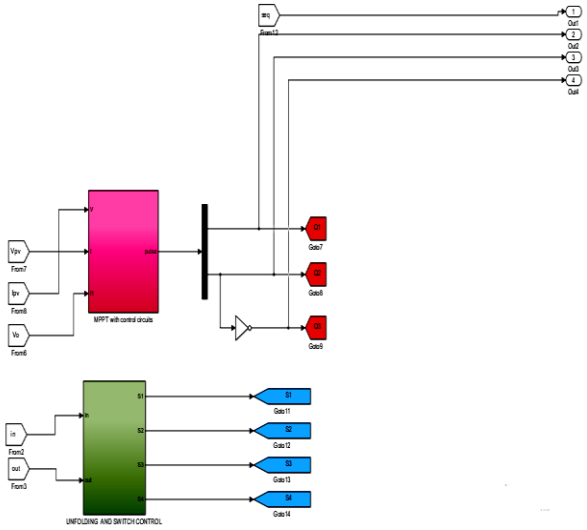


Fig 5. MPPT and Unfolding control.

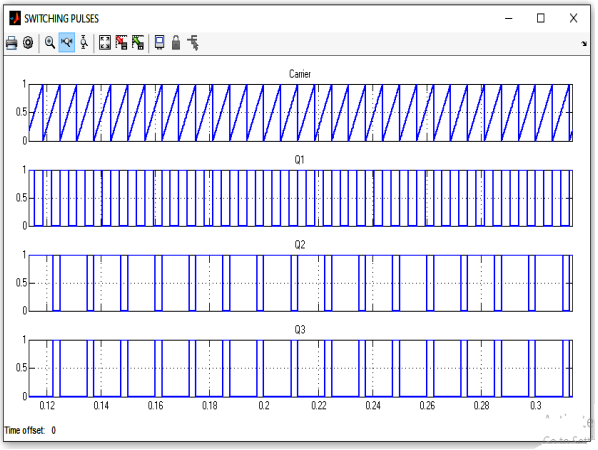


Fig 6. Switching pulse

International Journal of Science, Engineering and Technology

An Open Access Journal

Figure 6 is showing the switching pulse. The Q1, Q2 and Q3 are the various switches signals and carrier wave. It is used to switching pulse of the signal.

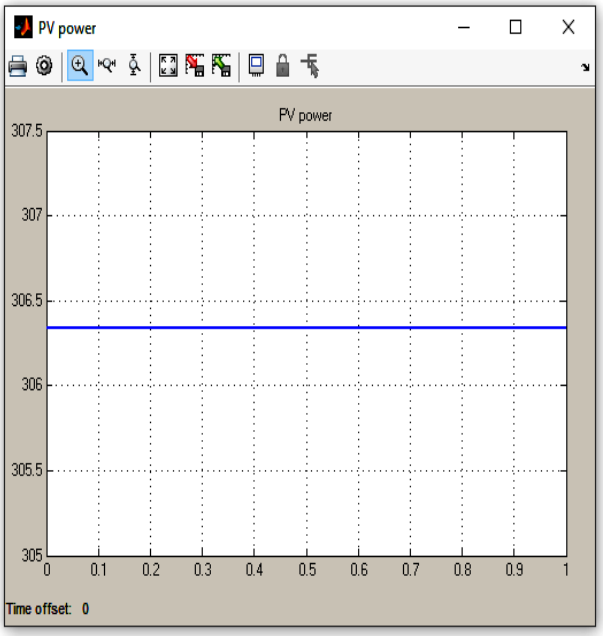


Fig 7. PV Power.

Figure 7 is showing the PV power of the present model. The value of the PV power is the 306.4 W.

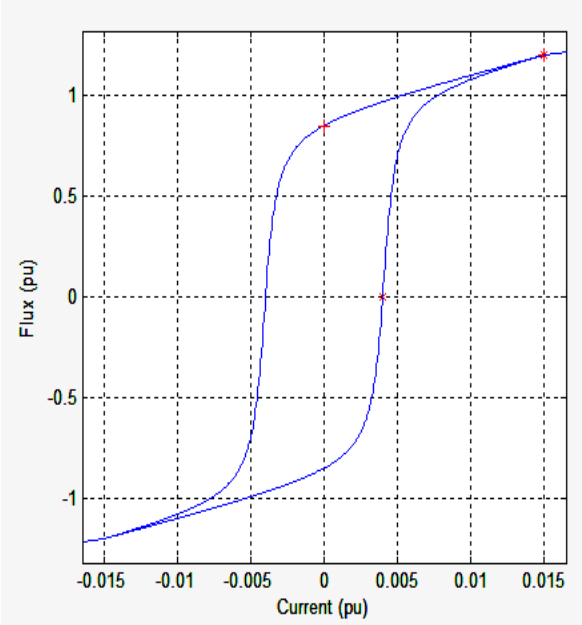


Fig 8. Hysteresis curve.

Figure 8 is showing the hysteresis curve regarding the current and flux esteems. A hysteresis circle shows the connection between the incited magnetic flux thickness B and the polarizing force H.

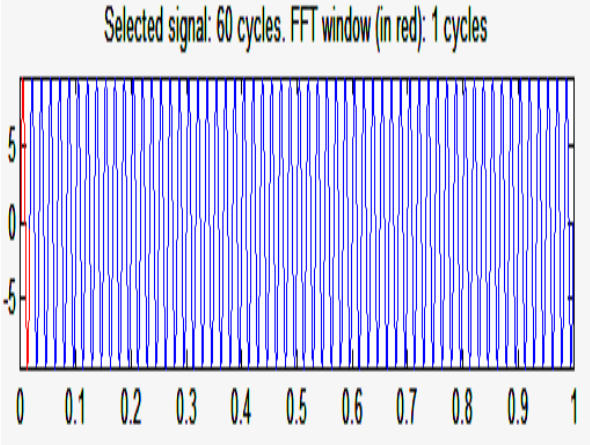


Fig 9. FFT analysis.

Figure 9 is showing the FFT analysis of the model. It converts a signal into individual spectral components and thereby provides frequency information about the signal.

Table 1. Simulation parameters.

| Sr. No | Parameter | Value |
|---|---|---|
| 1 | AC Grid Voltage | 320V |
| 2 | AC Grid Current | 9.5A |
| 3 | PV Power | 306.4 W |
| 4 | Total harmonic distortion | 0.19% |
| 5 | Efficiency | 97.5% |

Table 1 is showing the simulation performance parameters of present model. The AC grid voltage value is 320V and current value is 9.5A. The PV power is 306.4W and total harmonic distortion is 0.19%. The overall efficiency achieved is 97.5%.

Table 2. Results comparison of previous and present approach.

| Sr. No | Parameter | Previous Model | Present Model |
|---|---|---|---|
| 1 | Grid Voltage | 220V | 320V |
| 2 | Output Power | 240W | 306.4 W |
| 3 | THD | 2.175 % | 0.19% |
| 4 | Efficiency | 96.2% | 97.5% |

Table 2 is showing the results comparison of the previous and present model. The present model grid voltage is the 320V while previously it is 220V. The output power is the 306.4W while previously it is 240W. The total harmonic distortion is the 0.19% while previously it is 2.175 %. The overall efficiency is the 97.5% while previously it is 96.2%. Therefore the simulation results show that the present model is

International Journal of Science, Engineering and Technology

An Open Access Journal

achieving the significant better results than existing approaches.

## IV. CONCLUSION

The present model grid voltage is the 320V while previously it is 220V. The output power is the 306.4W while previously it is 240W. The total harmonic distortion is the 0.19% while previously it is 2.175 %. The overall efficiency is the 97.5% while previously it is 96.2%. Therefore the simulation results show that the present model is achieving the significant better results than existing approaches.

## FUTURE SCOPE

For the further investigates, more works are vital for DC-DC converters with different designs, particularly the converters dependent on SiC MOSFET. In expansion, it must be conceded that the strategies present in this work are not a total assurance conspire and when build up a security plot in further examination.

## REFERENCE

[1] F. Zhang, Y. Xie, Y. Hu, G. Chen and X. Wang, "A Hybrid Boost–Flyback/Flyback Microinverter for Photovoltaic Applications," in IEEE Transactions on Industrial Electronics, vol. 67, no. 1, pp. 308-318, Jan. 2020, doi: 10.1109/TIE.2019.2897543.

[2] F. Ronilaya, S. B. Kurniawan, M. N. Hidayat, E. Rohadi, R. Sutjipto and I. Siradjuddin, "A Power Sharing Loop Control Method for Input-series Output-parallel Flyback-type Micro-Inverter Using Droop Method," 2019 International Conference on Information and Communications Technology (ICOIACT), Yogyakarta, Indonesia, 2019, pp. 823-828, doi: 10.1109/ICOIACT46704.2019.8938411.

[3] C. Chen, J. Li, S. Gao and Y. Ma, "Design of Staggered Fly-back Single-phase Photovoltaic Grid-connected Micro-inverters," 2019 IEEE 3rd Information Technology, Networking, Electronic and Automation Control Conference (ITNEC), Chengdu, China, 2019, pp. 1793-1798, doi: 10.1109/ITNEC.2019.8729402.

[4] F. Zhang, Y. Xie, Y. Hu, G. Chen and X. Wang, "A Novel Dual-mode Micro-inverter for Photovoltaic AC Module Applications," 2019 IEEE Applied Power Electronics Conference and Exposition (APEC), Anaheim, CA, USA, 2019, pp. 127-132, doi: 10.1109/APEC.2019.8722184.

[5] E. KABALCI and A. BOYAR, "Design and Analysis of a Single Phase Flyback Micro Inverter," 2018 6th International Conference on Control Engineering & Information Technology (CEIT), Istanbul, Turkey, 2018, pp. 1-6, doi: 10.1109/CEIT.2018.8751843.

[6] R. de Oliveira Lima, L. H. S. C. Barreto and F. E. U. Reis, "Hybrid MPPT Control Applied to a Flyback Micro-Inverter Connected the Electrical Grid," 2018 13th IEEE International Conference on Industry Applications (INDUSCON), São Paulo, Brazil, 2018, pp. 59-64, doi: 10.1109/INDUSCON.2018.8627283.

[7] N. Falconar, D. S. Beyragh and M. Pahlevani, "A novel control system for solar tile micro-inverters," 2018 IEEE Applied Power Electronics Conference and Exposition (APEC), San Antonio, TX, 2018, pp. 375-380, doi: 10.1109/APEC.2018.8341038.

[8] D. Voglitsis, N. Papanikolaou and A. C. Kyritsis, "Incorporation of Harmonic Injection in an Interleaved Flyback Inverter for the Implementation of an Active Anti-Islanding Technique," in IEEE Transactions on Power Electronics, vol. 32, no. 11, pp. 8526-8543, Nov. 2017, doi: 10.1109/TPEL.2016.2646419.

[9] H. A. Sher, A. A. Rizvi, K. E. Addoweesh and K. Al-Haddad, "A Single-Stage Stand-Alone Photo voltaic Energy System With High Tracking Efficiency," in IEEE Transactions on Sustainable Energy, vol. 8, no. 2, pp. 755-762, April 2017, doi: 10.1109/TSTE.2016.2616443.

[10] F. Karbakhsh, M. Amiri and H. Abootorabi Zarchi, "Two-switch flyback inverter employing a current sensorless MPPT and scalar control for low cost solar powered pumps," in IET Renewable Power Generation, vol. 11, no. 5, pp. 669-677, 12 4 2017, doi: 10.1049/iet-rpg.2016.0631.

[11] Jiarong Kan, Yunya Wu, Ling Qin and Song Luo, "Integrated double dual-Mosfets photovoltaic micro-inverter with current-source characteristic, " 2017 IEEE 3rd International Future Energy Electronics Conference and ECCE Asia (IFEEC 2017 - ECCE Asia), Kaohsiung, 2017, pp. 134-139, doi: 10.1109/IFEEC.2017.7992431.

[12] M. A. Rezaei, K. Lee and A. Q. Huang, "A High-Efficiency Flyback Micro-inverter With a New Adaptive Snubber for Photovoltaic Applications," in IEEE Transactions on Power Electronics, vol. 31,

no. 1, pp. 318-327, Jan. 2016, doi: 10.1109/TPEL.2015. 2407405.

[13] M. Ahmed, X. Yapo, L. Huawu, L. Hang, G. Li and H. Haibing, "Two-stage single-phase photo voltaic grid-tied micro-inverter using soft-switching techniques," 2016 IEEE 2nd Annual Southern Power Electronics Conference (SPEC), Auckland, 2016, pp. 1-6, doi: 10.1109/SPEC.2016.7846048.

[14] M. Khalilian and P. Guglielmi, "Single-stage grid-connected flyback inverter with zero current switching for AC module application," IECON 2016 - 42nd Annual Conference of the IEEE Industrial Electronics Society, Florence, 2016, pp. 2390-2395, doi: 10.1109/IECON.2016.7793035.

[15] S. Poshtkouhi and O. Trescases, "Flyback Mode for Improved Low-Power Efficiency in the Dual-Active-Bridge Converter for Bidirectional PV Microinverters With Integrated Storage," in IEEE Transactions on Industry Applications, vol. 51, no. 4, pp. 3316-3324, July-Aug. 2015, doi: 10.1109/TIA.2015.2409179.

[16] A.C. Nanakos, G. C. Christidis and E. C. Tatakis, "Weighted Efficiency Optimization of Flyback Microinverter Under Improved Boundary Conduction Mode (i-BCM)," in IEEE Transactions on Power Electronics, vol. 30, no. 10, pp. 5548-5564, Oct. 2015, doi: 10.1109/TPEL.2014.2372005.

[17] M. Khalilian and E. Adib, "New single-stage soft-switching photovoltaic grid-connected flyback micro-inverter," 2014 19th Conference on Electrical Power Distribution Networks (EPDC), Tehran, 2014, pp. 42-46, doi: 10.1109/EPDC.2014.6867496.

[18] S. Zengin, F. Deveci and M. Boztepe, "Volt-second-based control method for discontinuous conduction mode flyback micro-inverters to improve total harmonic distortion," in IET Power Electronics, vol. 6, no. 8, pp. 1600-1607, September 2013, doi: 10.1049/iet-pel.2012.0168.

[19] C. Wu, D. Zhou and L. Fu, "Study of high-efficiency photovoltaic grid-connected micro-inverter control strategy," 2012 Power Engineering and Automation Conference, Wuhan, 2012, pp. 1-5, doi: 10.1109/PEAM 2012.6612438.

[20] H. Hu, Q. Zhang, X. Fang, Z. J. Shen and I. Batarseh, "A single stage micro-inverter based on a three-port flyback with power decoupling capability," 2011 IEEE Energy Conversion Congress and Exposition, Phoenix, AZ, 2011, pp. 1411-1416, doi: 10.1109/ECCE.2011.6063945.

[21] Q. Li and P. Wolfs, "A Review of the Single Phase Photovoltaic Module Integrated Converter Topologies with Three Different DC Link Configurations", IEEE Trans. on Power Electronics, vol. 23, no. 3, pp. 1320-1333, MAY 2008.

[22] Hu Haibing, Harb Souhib, Kutkut Nasser, Batarseh Issa and Z. John Shen, "Power Decoupling Techniques for Micro-inverters in PV Systems-a Review" in ECCE 2010, Altanta, pp. 3235-3240, Sept. 2010.

[23] Haibing Hu, Wisam AI-Hoor, Nasser Kutkut and Issa Batarseh, "Efficiency Improvement of Grid-tied Inverters at Low Input Power Using Pulse Skipping Control Strategy", IEEE Trans. On Power Electronics, vol. 25, no. 12, pp. 3129-3138, Dec. 2010.

[24] T. Shimizu, K. Wada and N. Nakamura, "Flyback-type single-phase utility interactive inverter with power pulsation decoupling on the dc input for an ac photovoltaic module system", IEEE Trans. Power Electron., vol. 21, no. 5, pp. 1264-1272, Sep. 2006.

[25] S. B. Kjaer and F. Blaabjerg, "Design optimization of a single phase inverter for photovoltaic applications", Proc. IEEE Power Electronics Specialists Conference, vol. 3, pp. 1183-1190, 2003.

[26] A.C. Kyritsis, N. P. Papanikolaou and E. C. Tatakis, "A novel Parallel Active Filter for Current Pulsation Smoothing on Single Stage Grid-connected AC-PV Modules", Proc. European Conf. Power Electronics and Applications (EPE), pp. 1-10, 2007.

[27] G. H. Tan, J. Z. Wang and Y. C. Ji, "Soft-switching flyback inverter with enhanced power decoupling for photovoltaic applications", IET Trans. Elect. Power Appl., vol. 1, no. 2, pp. 264-274, Mar. 2007.

[28] F. Shinjo, K. Wada and T. Shimizu, "A Single-Phase Grid-Connected Inverter with a Power Decoupling Function", Proc. IEEE Power Electronics Specialists Conference, pp. 1245-1249, 2007,June.