Journal of Engineering Sciences
Vol 10, Issue 11, Nov /2019
ISSN NO:0377-9254

AN IMPROVED METHODOLOGY FOR ENHANCING THE POWER FACTOR OF BRIDGELESS BUCK PFC CONVERTER

[1]A. Bhakthavachala, [2]S. Tara kalyani, [3]K. Anuradha, [4]G. Seetha Ravamma

[1]Research Scholar, Department of EEE, Jawaharlal Technological University, Hyderabad, India
[2]Professor & Head, EEE, Jawaharlal Technological University, Hyderabad, India
[3]Professor & Head, EEE, VNR Vignana Jyothi Institute of Technology, Hyderabad, India
[4] M. Tech Students, Department of EEE, PBR Visvodaya Institute of Technology, Nellore, A.P

Abstract— The bridgeless buck power factor correction (PFC) converters highlight the benefits of low output voltage and high effectiveness while their inclination existing dead angles in the input current break down the input current music and power factor (PF). Intending to decrease the dead angles, another bridgeless buck PFC converter is proposed in this paper. Through coordinating the fundamental buck circuit and the helper fly back circuit with one attractive centre, the dead angles in input current of the proposed bridgeless buck PFC converter is wiped out so the power factor and input current music are improved. The proposed bridgeless buck PFC converter is intended to work in spasmodic conduction mode (DCM) with the benefits of basic controller and nature current moulding capacity. Another logic control circuit is given. The itemized hypothetical inductions and structure thought are exhibited. The test examination among the proposed bridgeless buck PFC converter, the customary buck PFC converter and the ordinary bridgeless buck PFC converter is shown to approve the adequacy of the new converter.

I. INTRODUCTION

THE active power factor correction (PFC) converters are widely applied in power electronic equipment to meet the rigorous international input current harmonics standard like IEC 61000-3-2 limits. Commonly, the boost converter is the most popular option as the PFC front-end because of its simple topology, excellent current-shaping performance, easy control and low cost. Nevertheless, the boost PFC converter emerges two main drawbacks [4]. One is that its proficiency shows an undeniable drop around 1%-3% at low line contrasted with high line. Another is that its high output voltage (380-400V) is adverse to the exchanging misfortunes of lift PFC front-end and its down-stream DC-DC converter.

Lately, the conventional buck PFC converter as an option of lift PFC converter in low power level applications has gotten a lot of considerations by scientists and designers, since it can give high proficiency at low line and low output voltage. Some hypothetical examination and new topologies of the conventional buck PFC converter have been contemplated. Be that as it may, when the information voltage is lower than the output voltage, the created nature dead angles shown in Fig. 1 of the conventional buck PFC converter deteriorate the power factor (PF) and input current harmonics seriously. Thus, it is not easy for the conventional buck PFC converter to meet the input current harmonics standards.

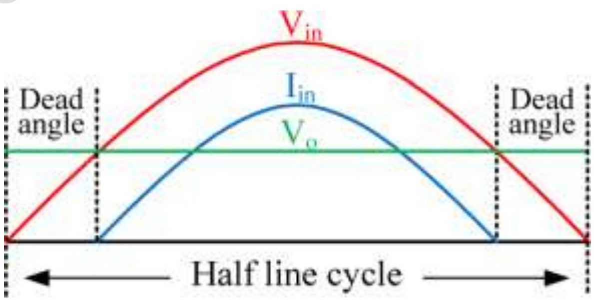


Fig. 1 Input current and input voltage of the conventional buck PFC converter.

II.LITERATURE SURVEY:

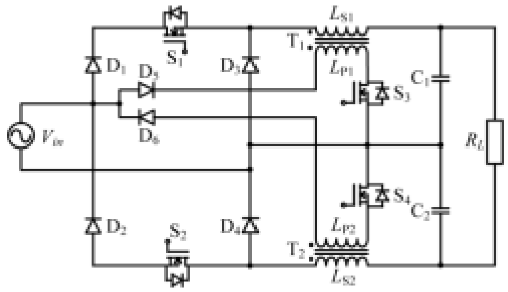
In order to improve the power factor and input current harmonics of the conventional buck PFC converter, some new control methods and new topologies were proposed. An improved peak current control scheme was proposed to improve the input current harmonics and the efficiency of the conventional buck PFC converter. A variable on-time (VOT) control method for conventional buck PFC converter was proposed to improve input current harmonics and power factor. A prediction of quadratic sinusoidal current modulation for

ISSN NO:0377-9254

conventional buck PFC converter was proposed to mitigate the dead angles. The above three control methods can alleviate the input current harmonics, but the inherent dead angles still exist so that the input current harmonics are still unsatisfied. A novel conventional buck PFC converter using one cycle control was proposed, which can reduce the dead angles. Some new integrated conventional buck and fly back circuits were proposed. When the input voltage is lower than the output voltage, the fly back circuit is active. Through this way, the dead angles of the above conventional buck PFC converters can be reduced. Also, a conventional buck PFC converter in series with an auxiliary fly back circuit was proposed. This PFC converter has only one power switch and the dead angles are reduced. Two conventional buck PFC converters combined with buck-boost circuit with reduced dead angles were proposed. A conventional buck PFC converter using an active buffer with reduced dead angles was proposed. A family of single-phase hybrid step-down PFC converters was introduced, which provide a systematically derivation methodology to construct a hybrid conventional buck PFC converter to reduce dead angles. In brief, all the above efforts are paid to improve the input current harmonics and power factor of the conventional buck PFC converter. However, the semiconductor loss of the conventional buck PFC converter is high, since there are always three semiconductors conducting in the current flowing path.

III.PROPOSED SYSTEM:

Compared to the conventional buck PFC converter, the bridgeless buck PFC converter owns a further improved efficiency due to the reduced number of simultaneously conducting semiconductor components. Up to now, some novel bridgeless buck PFC converters were proposed . By and by, the undesired dead angles are as yet produced in these bridgeless buck PFC converters. Meaning to decrease the dead angles in the bridgeless buck PFC converter, another bridgeless buck PFC converter appeared in Fig. 2 is proposed, dissected and approved in this paper. New bridgeless buck PFC converter is utilized for one cycle control was proposed, which can diminish the dead angles. some new coordinated conventional buck and fly back circuits were proposed. At the point when the input voltage is lower than the output voltage, the fly back circuit is dynamic. Through thusly, the dead angles of the above conventional buck PFC converters can be decreased. Likewise, a conventional buck PFC



converter in arrangement with a helper fly back circuit was proposed in A buck-type power-factor-correction circuit. This PFC converter has just one power switch and the dead angles are diminished. Two conventional buck PFC converters joined with buck-help circuit with decreased dead angles were proposed individually.

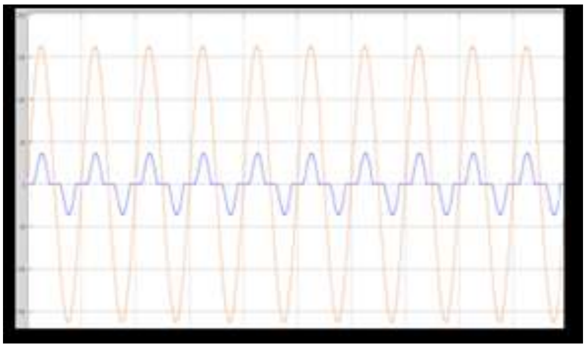
A conventional buck PFC converter using a active buffer with reduced dead angles. A family of single-phase hybrid step-down PFC converters was introduced. In brief, all the above efforts are paid to improve the input current the conventional buck PFC converter is high, since there are always three semiconductors conducting in the current flowing path. Compared to the conventional buck PFC converter, the bridgeless buck PFC converter owns a further improved efficiency due to the reduced number of simultaneously conducting semiconductor components. Up to now, some novel bridgeless buck PFC converters were proposed in Nevertheless, the undesired dead angles are still generated in these bridgeless buck PFC converters. Expecting to decrease the dead angles in the bridgeless buck PFC converter, another bridgeless buck PFC converter appeared in Fig. 2 schematic circuit of the bridgeless buck PFC converter is proposed, broke down and approved in this paper. In this new bridgeless buck PFC converter, the commitment of dispensed with dead angles is accomplished by utilizing the helper fly back circuit. Along these lines, higher power factor and lower input current music can be acquired .In the assistant fly back circuit of the proposed bridgeless buck PFC converter.

Fig. 2 Schematic circuit of the bridgeless buck PFC converter.

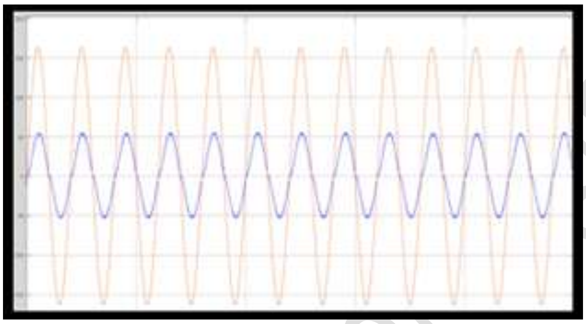
In this proposed bridgeless buck PFC converter have two power switches, two input rectifier diodes and two primary windings are required, the increased components in the auxiliary fly back circuit are not beneficial to the total cost and power density. Since the discontinuous conduction mode (DCM) is applied to the proposed bridgeless buck PFC converter, a simple control method, nature current shaping ability, zero-current turn on in the power switches and zero-current turn off in the output diodes are obtained. Also, a new logic control circuit is designed to further improve the driving loss.

IV.SIMULATION RESULTS:

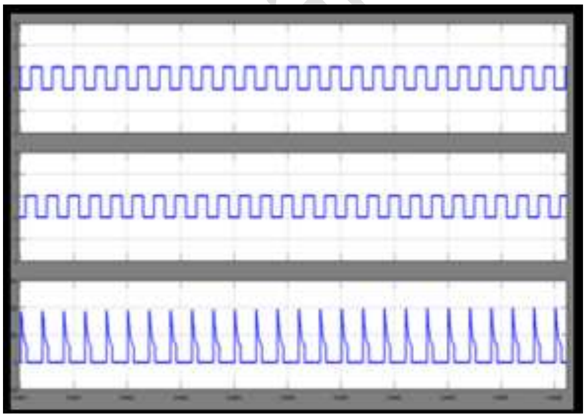
Input Voltage and Current Waveforms:



Fig, 3 AC input voltage and current of conventional buck PFC converter without fly-back circuit.



Fig, 4 AC input voltage and current of bridgeless buck PFC converter with auxiliary fly-back circuit.



Fig,5: Voltage across the Gate signals and current across secondary inductor 1 in proposed circuit.

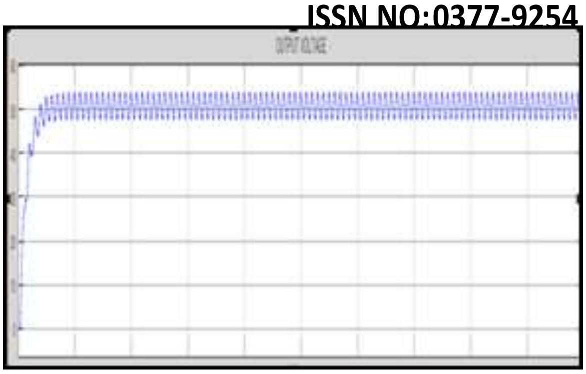


Fig 6 Output voltage waveform of conventional buck PFC converter without flyback circuit.

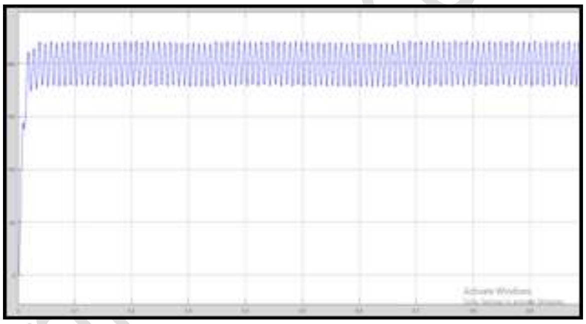


Fig 7: Output voltage waveform of bridgeless buck PFC converter with auxiliary flyback circuit.

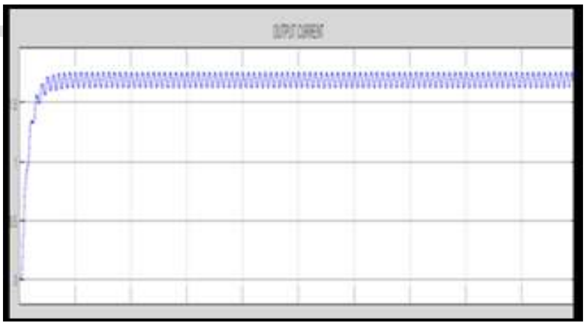
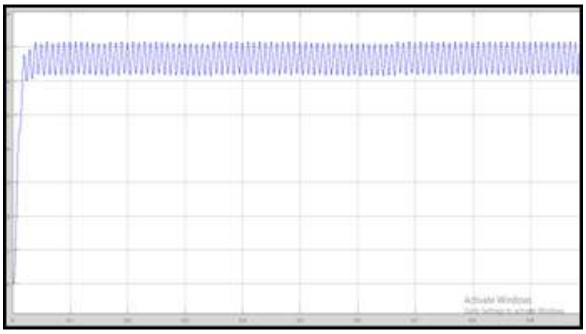


Fig 8: Output current waveform of conventional buck PFC converter without flyback circuit.



Fig, 9: Output current waveform of bridgeless buck PFC converter with auxiliary flyback circuit.

Vol 10, Issue 11, Nov /2019
ISSN NO:0377-9254

TABLE II:
Power factor improvement between conventional and bridgeless buck PFC converter

S NO	TYPE OF CONVERTER	POWERFACTOR
1	Conventional buck PFC converter without Fly-back circuit.	**0.967**
2	Bridgeless buck PFC converter with auxiliary Fly-back circuit.	**0.997**

V.CONCLUSION

A new bridgeless buck PFC converter with eliminated dead angles by utilizing assistant flyback circuit is proposed, investigated and approved in this paper. Because of the no-dead-point input current, the power factor and input current harmonics are improved essentially. A basic controller and nature input current-molding capacity are accomplished in DCM. The trial results confirm the hypothetical determination and show that the proposed bridgeless buck PFC converter has a more powerful factor contrasted with the conventional buck PFC converter and the conventional bridgeless buck PFC converter, and its input current harmonics are improved and fulfill the IEC61000-3-2 class D limits completely.

REFERENCES

[1]J. C. Salmon, "Circuit topologies for single-phase voltage-doubler boost rectifiers,"IEEE Trans. Power Electron., vol. 8, no. 4, pp. 521–529, Oct. 1993.

[2]L. Huber, Y. Jang and M. M. Jovanović, "Performance evaluation of bridgeless PFC boost rectifiers," IEEE Trans. Power Electron., vol. 23, no. 3, pp. 1381-1390, May. 2008.

[3]K. S. B. Muhammad and D. D. Lu, "ZCS bridgeless boost PFC rectifier using only two active switches," IEEE Trans. Ind. Electron., vol. 62, no. 5, pp. 2795-2806, May. 2015.

[4]L. Huber, G. Liu and M. M. Jovanović , "Design-oriented analysis and performance evaluation of buck PFC front end," IEEE Trans. Power Electron., vol. 25, no. 1, pp. 85-94, Jan. 2010.

[5]H. Endo, T. Yamashita, and T. Sugiura, "A high-power-factor buck converter," in Proc. IEEE Power Electron. Spec. Conf. , 1992, pp. 1071–1076.

[6]L. Yen-Wu and R. J. King, "High performance ripple feedback for the buck unity-power-factor rectifier," IEEE Trans. Power Electron. , vol. 10, no. 2, pp. 158–163, Mar. 1995.

[7]Y. S. Lee, S. J. Wang, and S. Y.R. Hui, "Modeling, analysis, and application of buck converters in discontinuous-input-voltage mode operation,"IEEE Trans. Power Electron., vol. 12, no. 2, pp. 350–360, Mar. 1997.

[8]V. Grigore and J. Kyyrä, "High power factor rectifier based on buck converter operating in discontinuous capacitor voltage mode," IEEE Trans. Power Electron., vol. 15, no. 6, pp. 1241–1249, Nov. 2000.

[9]J. Park and B. Cho, "The zero voltage switching (ZVS) critical conduction mode (CRM) buck converter with tapped-inductor," IEEE Trans. Power Electron., vol. 20, no. 4, pp. 762–774, Jul. 2005.

[10]W. W. Weaver and P. T. Krein, "Analysis and applications of a current- sourced buck converter," in Proc. IEEE Appl. Power Electron. Conf., Anaheim, CA, 2007, pp. 1664–1670.

[11]C. Chiang and C. Chen, "Zero-voltage-switching control for a PWM buck converter under DCM/CCM boundary," IEEE Trans. Power Electron., vol. 24, no. 9, pp. 2120–2126, Sep. 2009.

[12]X. Wu, J. Yang, J. Zhang, and M. Xu, "Design considerations of a high efficiency soft- switched buck AC–DC converter with constant on-time (COT) control," IEEE Trans. Power Electron., vol. 26, no. 11, pp. 3144–3152, Nov. 2011.

[13]Y. Chen, Y. Nan and Q. Kong, “A loss-adaptive self-oscillating buck converter for LED driving,” IEEE Trans. Power. Electron ., vol. 27, no. 10, pp. 4321-4328, Oct. 2012.

[14]D. D. Lu and S. Ki, “Light-load efficiency improvement in buck-derived single-stage single-switch PFC converters,” IEEE Trans. Power Electron., vol. 28, no. 5, pp. 2105–2110, May. 2013.

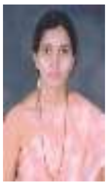
[15]H. Choi, “Interleaved boundary conduction mode (BCM) buck power factor correction (PFC) converter,” IEEE Trans. Power Electron., vol. 28, no. 6, pp. 2629–2634, Jun. 2013.

[16]A. Emrani, M. R. Amini and H. Farzaneh-Fard, “Soft single switch resonant buck converter with inherent PFC feature,” IET Power Electron. vol. 6, no. 3, pp. 516–522, 2013.

Author Profile:

A.Bhaktha vachala received the B.Tech. degree from PBR VITS in the year 2003 and M.Tech. degree from the JNTU, Hyderabad, India. Also perusing Ph.D. degree from Jawaharlal Nehru Technological University, Hyderabad. He is working in the area of Electric vehicle applications in transportation systems from last four years. He has been with the Department of Electrical and Electronics Engineering, PBR Visvodaya Institute of technology and science, Kavali affiliated by JNTU Anantapur since last 10years, where he is currently an Associate Professor. His research interests include several areas of power electronics and electric vehicle applications of power electronics. He has authored or coauthored several papers in power electronics. He holds a UGC sponsored project worth of 4,60,00/-. Member in ISTE.

Dr. S. Tara Kalyani received the B.Sc. degree in electrical engineering from Osmania University, Hyderabad, India in 1995 and the M.Sc. degree in electrical engineering from Jawaharlal Nehru Technological university, Hyderabad, India, in 1998. And Ph.D., degree in electrical engineering from the Jawaharlal Nehru Technological University, Hyderabad, India, in 2008. She is currently with the Department of Electrical and Electronics Engineering in the Jawaharlal Nehru Technological University, Hyderabad, India, as a Professor and head of the department. Her research interest includes Power Electronics, Control Systems, Fundamentals of Electrical Engineering, Energy Systems, Power Systems. She is a life member of Indian Society for Technical Education.



Dr.K. Anuradha received the B.E degree in electrical engineering from Andhra University, Vizag, India; and the M.E. degree in electrical engineering from Osmania University, Hyderabad, India. And Ph.D. degree in electrical engineering from Osmania University, Hyderabad, India, in 2011.She is currently with the department of electrical and electronics engineering in the VNR Vignana Jyothi Institute of Engineering & Technology Hyderabad, India, as a Professor and head of the department. Her research interest includes Power Electronics and Drives. She is a life member of Indian Society for Technical Education. She completed so many research projects from AICTE and UGC as a Principle Coordinator. And almost 19 years of teaching experience.

Seetharavamma Gopidesi Received the B.Tech degree in Electrical engineering from PBR VITS in the year 2012 and Perusing M.Tech degree from PBR VITS,Kavali,Nellore Dt,A.P.