International Journal of Engineering Research and General Science Volume 2, Issue 3, April-May 2014
ISSN 2091-2730

Simulation & Performance Parameters Analysis of Single- Phase Full Wave Controlled Converter using PSIM

Amit Solanki[1]

[1]Assistant professor, EEE Department LNCT Indore (M.P), India

E-mail- Solanki_amit04@yahoo.co.in

Abstract- This Paper may be focused on power Electronics Converter Circuits modelling and Simulation and their analysis on the basis of some performing parameters. This paper deals with the analysis and Simulation of Single-phase full- wave ac to dc converter analysed on the basis of performing parameters and simulated with different types of loads. A Simulation Result, which includes a study of performance parameters like ,PF, FF, V_{avg} , V_{rms}, I_{avg}, ,I_{rms} and Efficiency etc. agree with the theoretical results .the development of model is useful for computer aided analysis and design of full converter including firing circuits. A phase-controlled converter is an integral part of any power supply unit used in the all electronics equipments; also it is used as an interface between utility and most of the power electronics equipments. Single phase converters are also used to drive the induction motors.

Keywords- Power Simulator Software (PSIM), Single-phase Full controlled converter, performing Parameters, R, L, C Loads.

INTRODUCTION - Power electronics Controlled converter is a type of semiconductor converter which is used for the conversion of AC to DC , DC to AC , AC to AC , DC to DC power .Power Electronics is used to change the Characteristics of electrical power to suit a particular application.It is an interdisciplinary technology. The Thyristor can be triggered at any angle α in positive half cycle and thus the output voltage can be controlled. The Thyristor blocks during the negative half cycle. in fig shown the waveforms of different types of loads. Full wave controlled converter which provides higher dc output voltage.

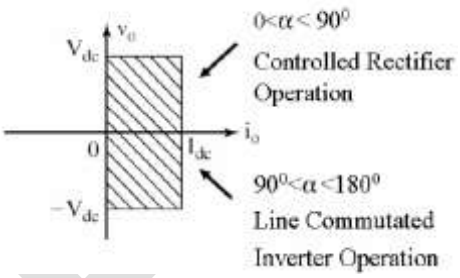

Fig-1 Rectifier quadrant operation.

PERFORMANCE PARAMETERS- The analysis of the full wave converter is done by considering Following Parameters.

1. Form Factor: - $FF = V_{rms} / V_{dc}$
2. Ripple Factor:- $RF = \sqrt{(FF^2 - 1)}$
3. TUF:- $P_{dc} / V_s I_s$
4. Efficiency:- $\eta = P_{dc} / P_{ac}$
5. Power Factor

SIMULATION- The PSIM simulation model of single phase half Wave rectifier is shown in fig 3. While in fig4

And fig5 for firing pulse generation and waveform For performance parameter calculation is shown Respectively. PSIM is a Simulation Software Specially designed for Power electronics and Motor drives module. With fast Simulation and
User friendly interface, PSIM provides powerful Simulation environment for power electronics. PSIM simulation environment consists of the Circuit schematic program PSIM, the simulator Engine and the waveform processing program Simview. The Simulation process is shown as Follows.

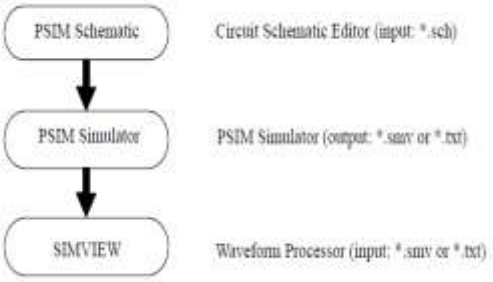

Fig-2 PSIM Environment

Advantages of PSIM:-

1) With PSIM's interactive simulation capability you can change parameter values and view voltages/currents in the middle of a simulation.

2) You can design and simulate digital power supplies using PSIM's Digital Control Module. The digital Control Can be implemented in either block diagram or custom C code.

3) PSIM has a built-in C compiler which allows you to enter your own C code into PSIM Without Compiling. This makes it very easy and flexible to implement your own function or control methods.

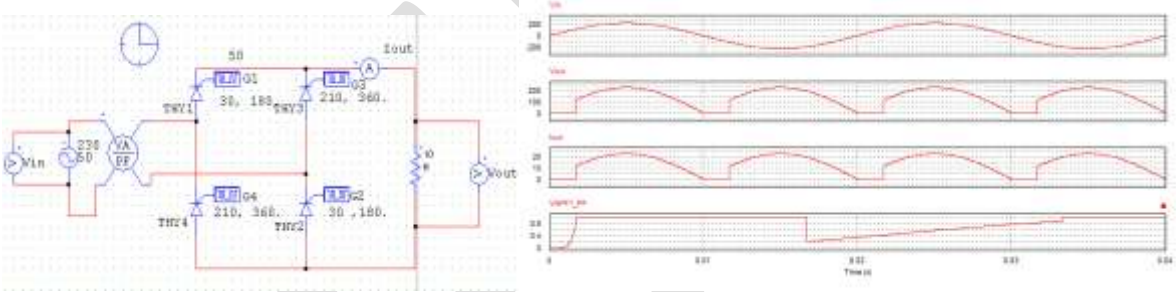

Fig-3 PSIM Simulated Model and Simulation results for FW Rectifier with R-load

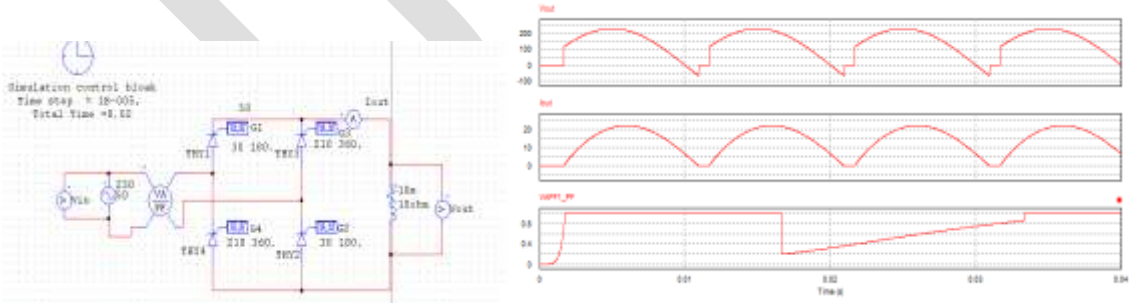

Fig-4 Simulated Model and Simulation Results for FW Rectifier with RL-load

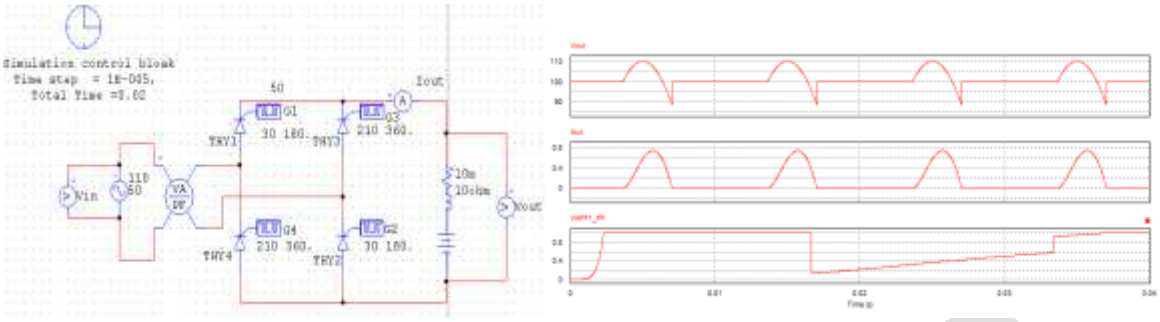

Fig-5 Simulated Model and Simulation Results for FW Rectifier with RLE-load

SIMULATION RESULTS - The Tabular form result is shown at R, L, E, Loads and firing angles as Follows :-

Table 1.1 R Load (V_{in} = 110 volts, R = 5 ohms)

A	30˚	60˚	90˚	120˚
V_{avg}	136.6	109.78	73.09	36.63
I_{avg}	13.66	10.97	7.30	3.66
V_{rms}	160.2	145.8	114.88	71.95
I_{rms}	16.02	14.58	11.48	7.19
Form Factor	1.17	1.32	1.57	1.96
Ripple Factor	0.17	0.32	0.57	0.96
Power factor	0.99	0.98	0.879	0.499
η	72.2%	56.5%	40.45%	25.48%

Table 1.2 RL Load (V_{in} = 110 volts, R = 10 ohms, L=10mh)

A	30˚	60˚	90˚	120˚
V_{avg}	134.1	107.27	52.43	21.15
I_{avg}	13.24	10.56	5.10	2.02
V_{rms}	160.6	146.24	96.43	55.28
I_{rms}	15.19	13.37	8.10	4.18
Form Factor	1.19	1.36	1.83	2.61

Ripple Factor	0.19	0.36	0.83	1.61
Power factor	1.0	0.98	0.6	0.4
η	72.77%	58.35%	34.18%	5.5%

Table 1.3 RLE Load (V_{in} = 11 0 volts, R = 10 ohms, L=10mh, E=100 volts)

α	**30°**	**60°**	**90°**	**120°**
V_{avg}	101.4	101.4	100.6	99.9
I_{avg}	14.6	14.6	0.063	0.05
V_{rms}	101.5	101.5	100.6	99.9
I_{rms}	28.9	28.9	0.15	0.10
Form Factor	1.0	1.0	1	1
Ripple Factor	0	0	0	0
Power factor	0.99	0.98	0.85	0.89
η	50.51%	50.51%	42.2%	49.94%

CONCLUSION-

The design of ac to dc single phase full controlled Converter was simulated in PSIM software. The firing Circuit was designed and different types of waveforms are generated for the measurement of performance Parameters were developed. The performance parameters Was Calculated with the help of waveform developed in PSIM Simulator and These parameters matched with Actual performing parameters. Then tabulated the Performing parameters for various loads and different Firing angles and analyzed on these parameters value. These simulated performing parameters are used in many industrial applications where controllable dc power required and it is also useful in educational purpose for engineering students and Laboratory experiments.

REFERENCES :

[1] Amit Solanki, " Simulation and performance Parameters Analysis of Single-phase half controlled converter using PSIM published in International Conference at Mangalmay Institute of Engineering and Management, Delhi During 1-2nd March-21014, (Paperback ISBN : 978–93–5156–339– 6), Online ISSN: 2230-729X).

[2] Santosh S. Raghuwanshi, Ankita Singh,Yamini Mokhariwale. "A comparison and performance of Simulation Tools MATLAB/ SIMULINK, PSPICE, & PSIM for power Electronics Circuits" International journal of Advanced Research in Computer Science and Software Engineering. Volume-2 Issue-3,March 2012 ISSN: 2277 128X

[3]] Sameer Khader, Alan Hadad and Akram A, Abu.The application of PSIM & MATLAB /SIMULINK in Power Education Conference (EDUCON) ,Jordan 118-121.

[4] D.Venkatasubramanian1 S. P. Natarajan1, B. Baskaran 2 and S. Suganya3." Dual Converter Controlled Single Phase Matrix Converter Fed DC Drive "ARPN Journal of Engineering and Applied Sciences VOL. 7, NO. 6, JUNE 2012 ISSN 1819-6608.

[5] Suryaprakash Singh1, Dharmesh Pandya2, Monika Patel3 "High Power Factor Operation of a 1-Phase Rectifier for an Adjustable Speed Drive." NATIONAL CONFERENCE ON EMERGING TRENDS IN COMPUTER & ELECTRICAL ENGINEERING, ETCEE2014

[6] Elena Niculescu, E. P. Iancu, M. C. Niculescu and Dorina-Mioara Purcaru (2006) Analysis of PWM Converters Using MATLAB. Proceedings of the 6th WSEAS International Conference on Simulation, Modeling and Optimization, Lisbon, Portugal, September, 507-512.

[7] " Power Simulator Software (PSIM) user guides''.

[8] Aslam P. Memon, Ahsan Zafar, M. Usman Keerio, Waqar Ahmad Adil, Asif Ali. A . "Experimental Study and Analysis ofHarmonics Generation in Uncontrolled and Controlled Rectifier Converters" International Journal of Scientific & Engineering Research, Volume 5, Issue 1, January-2014 ISSN 2229-5518.

[9] Santosh S. Raghuwanshi, Kamlesh Gupta, Purva Trived. "Computer Simulation and Analysis of Power Electronic Circuit in Different Simulation Tools" ISSN: 2277-4629 (Online) | ISSN: 2250-1827 (Print) CPMR-IJT Vol. 2, No. 2, December 2012.

[10] Dr. P.S. Bimbhra. " Power Electronics" Khanna Publishers Fifth Edition ISBN No.-978-81-7409-279-3.

[11] Meenakshi, J. ; Dash, S.S. ; Thyagarajan, T.,sahoo A,K, Power Electronics, 2007. ICPE '07. 7th Internatonal Conference on 22-26 Oct. 2007, E-ISBN :978-1-4244-1872-5.

[12] Deokyoung Lim, Windarko, N.A. ; Jaeho Choi "PSIM based dynamic simulator for analysis of SPHEV operation"power electronics and application (EPE-2011) proceeding of the 2011-14th European conference, E-ISBN :978-90-75815-15-3Print ISBN:978-1-61284-167-0, Aug. 30 2011-Sept. 1 2011.

[13] Yang Jun, ; Lian Xiaoqin ; Zhang Xiaoli ; Duan Zhengang" Versatile PSIM Simulation Model for Photovoltaic Array with MPPT Function" Intelligent Computation Technology and Automation (ICICTA), 2011 International Conference on (Volume:1), Page(s):987 - 990Print ISBN: 978-1-61284-289-9 date-28-29 March 2011.