# A THREE LEVEL FULLY INTEGRATED SINGLE STAGE AC-DC CONVERTER

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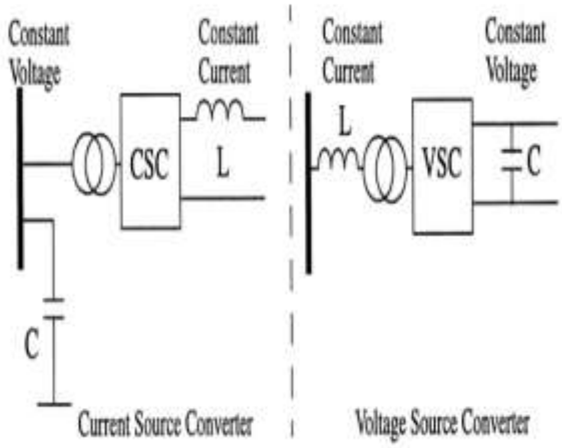
**Abstract:**
*Proposed a closed loop control of a three-level integrated ac–dc converter is presented. The proposed converter integrates the operation of the boost power factor correction and the three-level dc–dc converter. By the implementation of PI controller with PWM technique in closed loop, the switching sequence is under controlled condition and the output voltage of the proposed converter effectively increases. The converter is made to operate with two independent controllers—an input controller that performs power factor correction and regulates the dc bus and an output controller that regulates the output voltage. The input controller prevents the dc-bus voltage from becoming excessive while still allowing a single-stage converter topology to be used. The project explains the operation of the proposed converter in detail and discusses its features and a procedure for its proper design*

## 1.0 Introduction:

The advances in power semiconductor devices have led to the increased use of solid-state converters in various applications such as air conditioning, refrigeration, pumps, etc. employing variable frequency induction motor drives . These variable frequency drives generally use the three-phase squirrel cage induction motor as the prime mover due to its advantages like rugged, reliable, maintenance free, etc. These induction motor drives are mostly operated in a vector control mode due to its capability of giving a performance similar to that of a DC motor. These drives are fed by a six-pulse diode bridge rectifier, which results in injection of harmonics in the supply current, thus deteriorating the power quality at the point of common coupling (PCC), thereby affecting the nearby consumers. To have a control on these harmonics, an IEEE Standard 519 has been reissued in 1992, giving the benchmark for limiting current and voltage distortion.

A HVDC system requires an electronic converter for its ability of converting electrical energy from ac-dc or vice versa. There are basically two configuration types of three-phase converters possible for this conversion process
Current Source Converter (CSC),
Voltage Source Converter (VSC)




Due to the finite leakage inductance $l_c$ of the converter transformer, commutation from one valve to the next is not instantaneous. An overlap periodis necessary and, depending on the value of the leakage, either two, three orfour valves may conduct at any one time. In the most general case, with a typical value of converter transformer leakage impedance of between 13- 18%, either two or three valves conduct at any one time. Essentially, this results as an overlap angle µ which is less than 60 degrees; typically, it is in the range of 20 to 25 degrees. During commutation, three valves conduct and in-between commutations only two valves conduct. The case of either two or three conducting valves is shown

## 2.0 Methodology:

A phase-shifted voltage (e.g., $V_{a}{}'$) is obtained by tapping a portion (0.0843) of line voltage $V_{bc}$ and connecting one end of approximately 0.229 of the line voltage (e.g., $V_{ca}$ ) to this tap. The kVA rating of the transformer is calculated as

where $V_{winding}$ is the voltage across one winding and $I_{winding}$ is the current flowing at full load through the same winding. The kVA rating of the interphase transformer and the zero sequence blocking transformer (ZSBT) is also calculated using the above relationship.

AC Drives -

Introduction

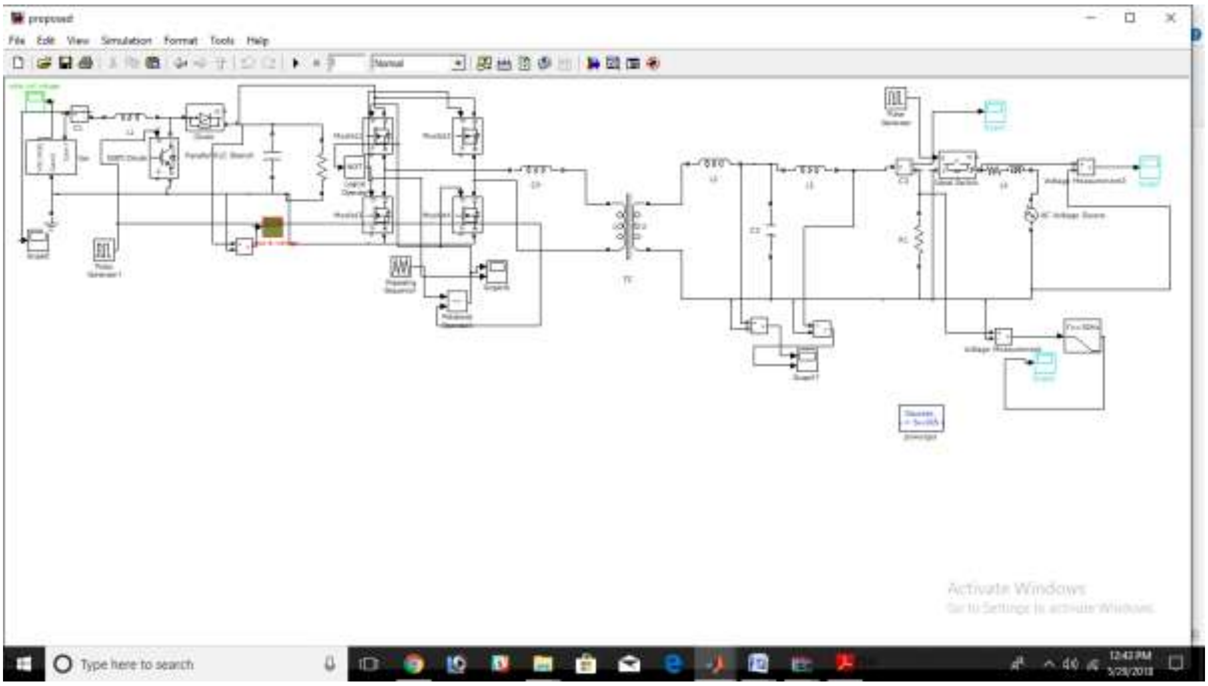
- Small size
- Robust
- Simple in design
- Light and compact
- Low maintenance
- Low cost

The evolution of AC variable speed drive technology has been partly driven by the desire to emulate the performance of the DC drive, such as fast torque response and speed accuracy, while utilising the advantages offered by the standard AC motor.

Design of an Autotransformer for the 24-Pulse Converter

To achieve the 12-pulse rectification, the necessary requirement is the generation of two sets of line voltages of equal magnitude that are 30 $^{o}$ out of phase with respect to each other. The number of turns required for the 0 $^{o}$ and 30 $^{o}$ phase shift is calculated as follows: Consider phase

**3.0 Results and discussions:**



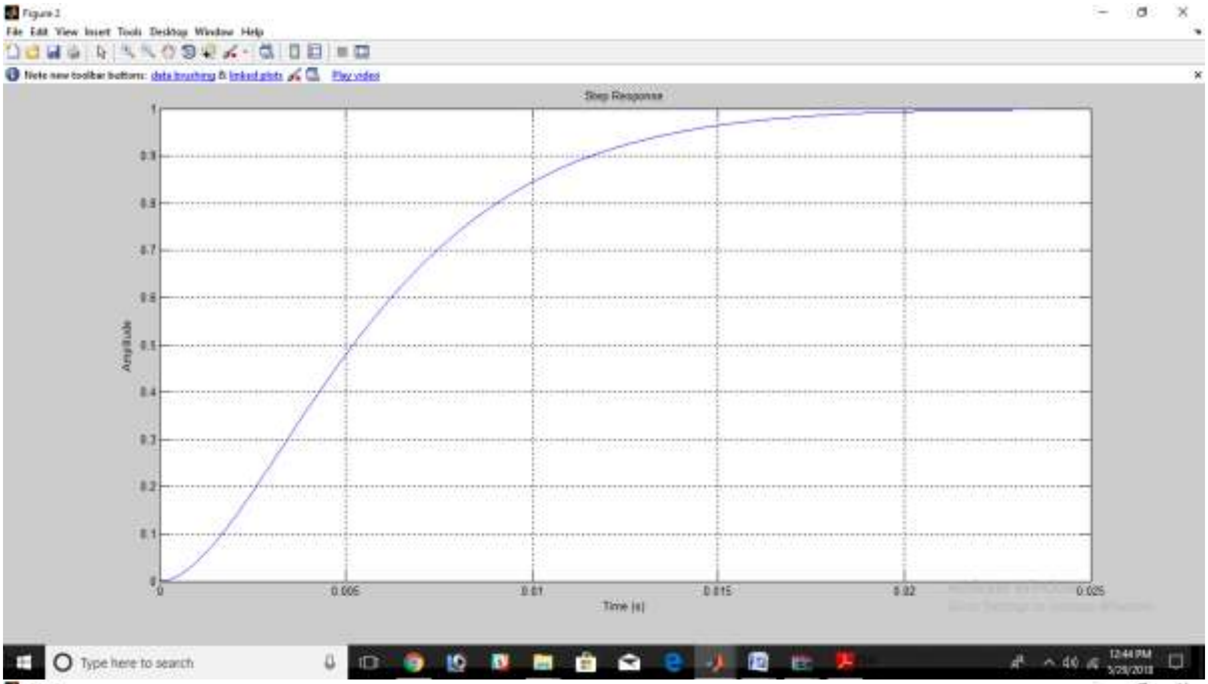


Figure 2
Step Response
Amplitude
Time (s)

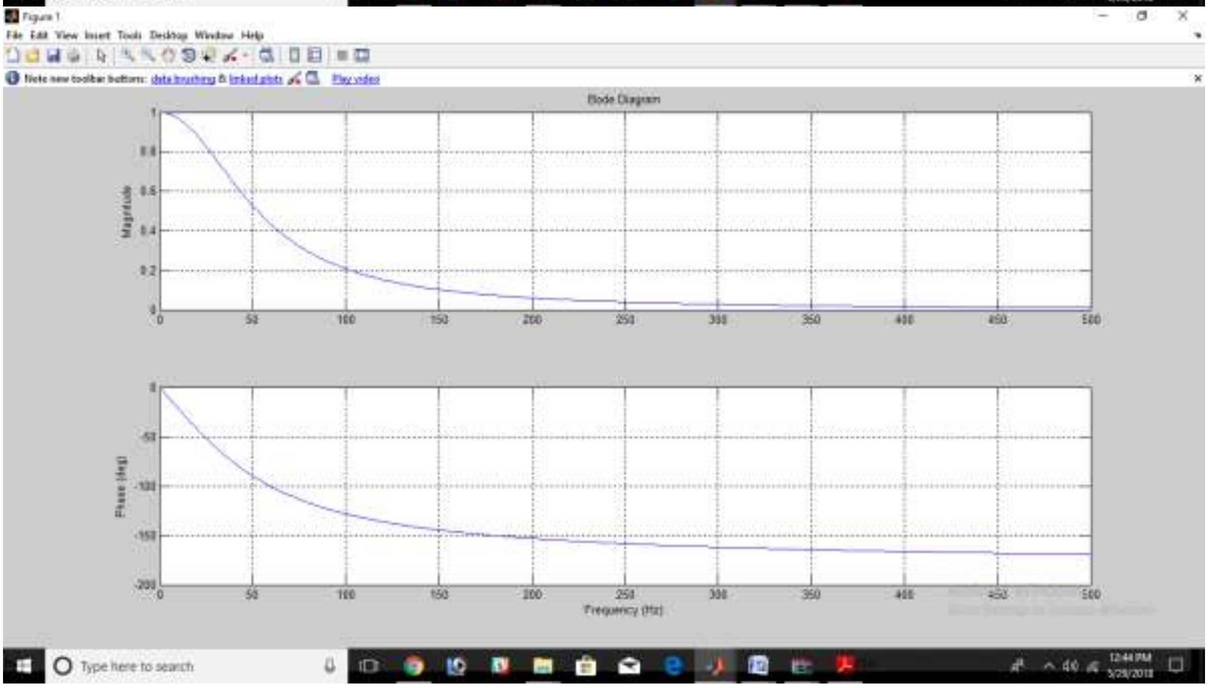
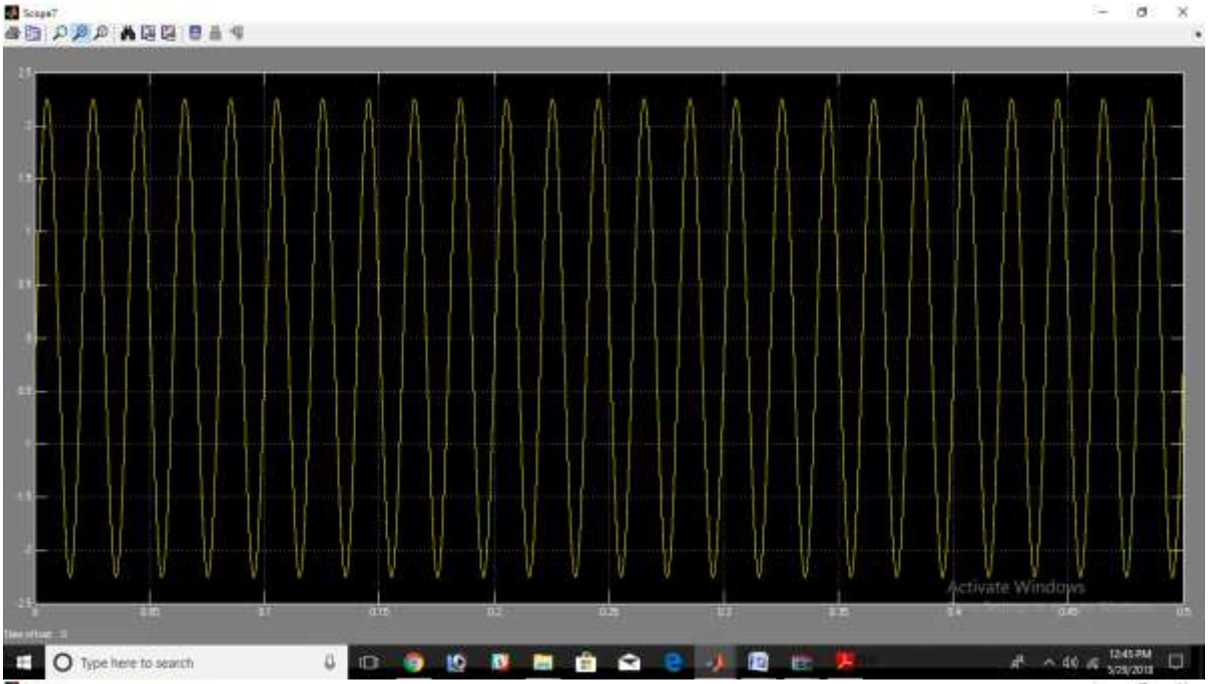
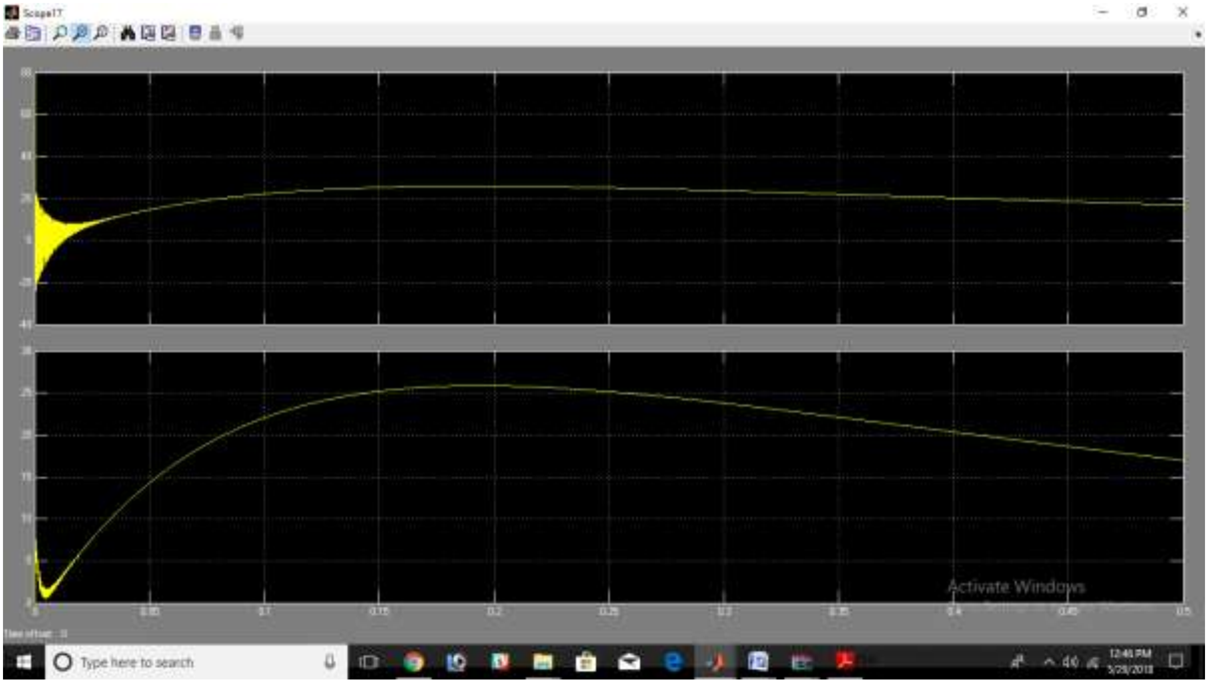
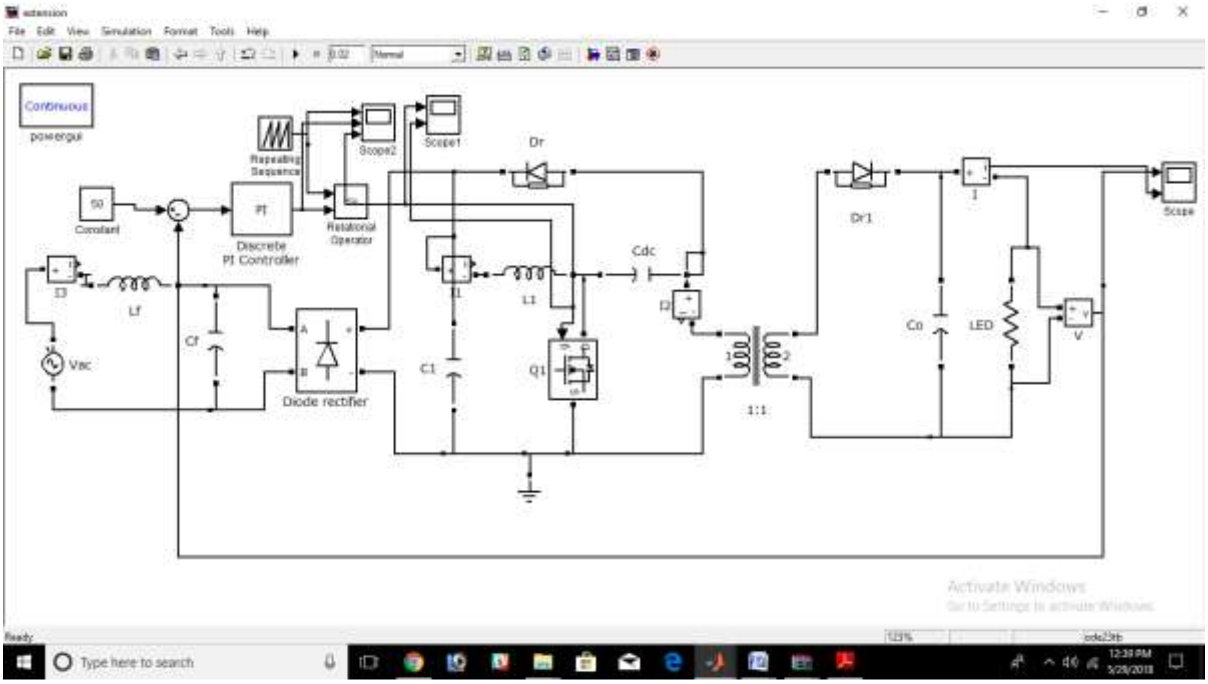


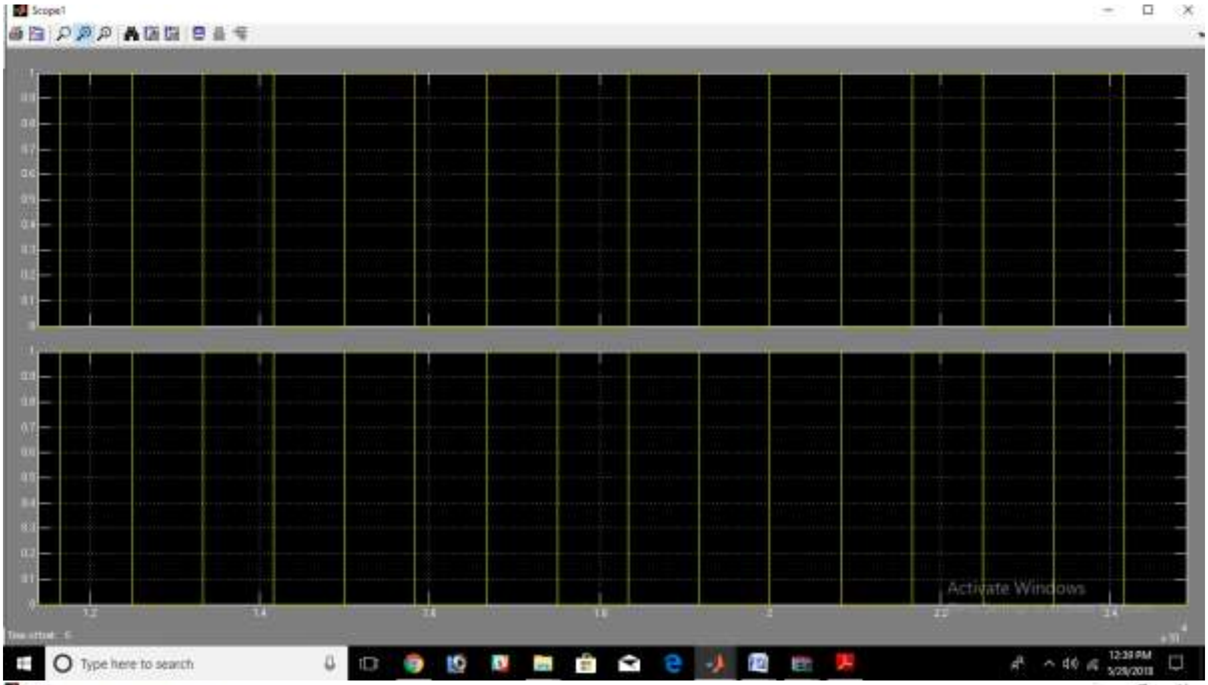
Figure 1
Bode Diagram
Magnitude
Phase (deg)
Frequency (Hz)

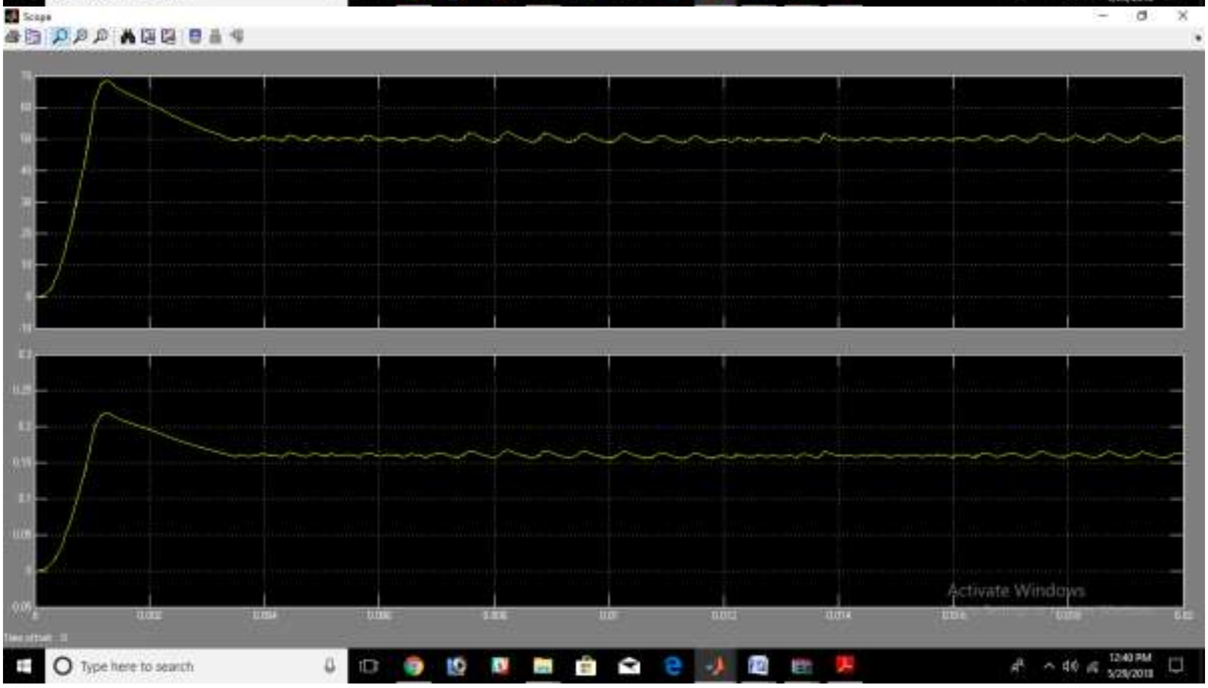




**Extension**


Continuous
powergui
Repeating Sequence
Scope2
Scope1
Dr
Constant
Discrete PI Controller
Relational Operator
Cdc
Dr1
Scope
Lf
Cf
Vac
Diode rectifier
C1
L1
Q1
1:1
Co
LED
V





## CONCLUSION:

A new multilevel single-stage AC-DC converter is proposed in the paper. This converter is operated with two controllers – one controller that performs input PFC and a second controller that regulates the output voltage. The outstanding feature of this converter is that it combines the performance of two-stage converters with the reduction of cost of single-stage converters. The paper introduces the proposed converter, explains its basic operating principles and modes of operation, and discusses its design with respect to different DC bus voltages. Experimental results that confirm the feasibility of the converter are also presented in the paper.

## REFERENCES

[1] J.M. Kwon, W.Y. Choi, B.H. Kwon, "Single-stage quasi-resonant flyback converter for a cost-effective PDP sustain

power module," *IEEE Trans. on Ind. Electron.*, vol. 58, no. 6, pp 2372-2377, 2011.

[2] H. Ma, Y. Ji, Y. Xu, " Design and analysis of single-stage power factor correction converter with a feedback winding," *IEEE Trans. On Power Electron.*, vol. 25, no. 6., pp. 1460-1470, 2010.

[3] H.S. Athab, D.D.-C. Lu, "A high-efficiency ac/dc converter with quasi-active power factor correction," *IEEE Trans. on Power Electron.*, vol. 25, no. 5., pp. 1103-1109, 2010.

[4] H. Athab, D. Lu, "A single-switch ac/dc flyback converter using a CCM/DCM quasi-active power factor correction front-end," *IEEE Trans. on Ind.. Electron.*, vol. --, no. 99., pp. 1, 2011.

[5] H.J. Chiu, Y.K. Lo, H.C. Lee, S.J.Cheng, Y.C. Yan, C.Y. Lin, T.H. Wang, S.C. Mou, "A single-stage soft-switching flyback converter for power-factor-correction applications," *IEEE Trans. on Ind. Electron.*, vol. 57, no. 6., pp. 2187-2190, 2011.

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