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ACTIVE CURRENT SHAPING FOR BETTER UTILITY INTERFACE

A dissertation submitted to the
Department of Electrical Engineering, University of Moratuwa
in partial fulfillment of the requirements for the
degree of Master of Science

by

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January 2009

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DECLARATION

The work submitted in this dissertation is the result of my own investigation, except where otherwise stated.

It has not already been accepted for any degree, and is also not being concurrently submitted for any other degree.

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I endorse the declaration by the candidate.

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Dr. J.P. Karunadasa

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ABSTRACT

Increased use of nonlinear electrical loads injects harmonic currents to power systems. High levels of power system harmonics create voltage distortion and enlarge power quality problems. Harmonics result in poor power factor, lower efficiency and interference to adjacent communication systems. The harmonic currents flow into the utility supply lines produces extra losses. An active power filter uses a switching inverter to produce harmonic compensating currents.

The major objective of this project was to eliminate effects of harmonics and to improve power factor of a typical nonlinear load. Attempts were made to apply active power filters for current shaping of a specific load, contrary to its common applications of applying at the point of common coupling.

The National Instruments USB-6008 multifunction data acquisition (DAQ) module was used to acquire data from the sample load *viz.* the computer power supply. A potential divider was incorporated to the circuit to acquire voltage signal. Current signal was acquired using a series resistor.

Filter current was implemented by switching an inductor using four insulated gate bipolar transistors (IGBT) arranged in H bridge configuration. The simulation circuit was implemented using MATLAB Simulink software tool. Inductance of the switching inductor, voltage of the step up transformer and the switching frequency of the system were obtained by simulation. Subsequently the above circuit parameters were validated for variable loads using total harmonic distortion as the discerning criterion.

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It was possible to reduce THD of the current wave of computer power supply from 107% to 12%. Power factor was improved from 0.66 to unity. By increasing the power factor to unity, the current flow can be reduced by approximately 34%. The observations made herein are applicable for harmonic elimination in nonlinear loads in general with necessary modifications.

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ACKNOWLEDGEMENT

I am greatly indebt to my supervisor Dr. J.P. Karunadasa , Head of Department, Department of Electrical Engineering, University of Moratuwa, Moratuwa for his ever present words of wisdom. Department of Electrical Engineering, and the Department of Mechanical engineering of the University of Mratuwa, Moratuwa for providing me this immensely valuable opportunity to carry out a postgraduate project with all the facilities and guidance in a pleasant environment.

I wish to record my gratitude to the laboratory staff the Department of Electrical Engineering, University of Moratuwa, Moratuwa for the technical support in carrying out my research work. Further to the staff of the Regional support Center (Southern/Uva) of National Water supply and Drainage Board, Matara for their support.

Finally, I should thank many individuals, friends and colleagues who have not been mentioned here personally in making this educational process a success. May be I could not have made it without your supports.

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