DESIGN AND IMPLEMENTATION OF AN ELECTRONIC FAN REGULATOR FOR REDUCED HARMONICS AND RIPPLE FREE SPEED

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Dissertation submitted in partial fulfillment of the requirements for the degree Master of Science in Electrical Engineering

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DECLARATION

I declare that this is my own work and this dissertation does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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K. K. C. S Kiriella

The above candidate has carried out research for the Masters Dissertation under our supervision.

Signature of the supervisor: Date:

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Prof. J. P. Karunadasa

Signature of the supervisor: Date:

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Dr. W. D. A. S Rodrigo

Abstract

A ceiling fan regulator is needed to control the speed of a ceiling fan. With the development of power electronic switching devices, electronic (triac based) fan regulator has been introduced to the market by ceiling fan manufacturers. Compared to old fan controlling methods like inductive and resistive fan controller, this method offers advantages like low power dissipation, compactness, step-less control etc.

Since this electronic fan regulator controls the effective voltage to the ceiling fan by chopping the waveform, it generates current and voltage harmonics. Speed ripples, low power factor issues, humming noises, mechanical oscillations, additional heating of the ceiling fan can be observed because of these low quality waveforms.

This research investigated a suitable power electronic based fan regulator for reduced harmonics and ripple free speed. The study was carried out by choosing 6 different power electronic based single phase motor controlling methods and examining their technical aspects and market competitiveness as a ceiling fan regulator.

Out of these 6 methods, DC chopper fed controller showed comparatively a best possible solution for above mentioned problems. Moreover, the simulation results were validated by implementing a prototype of a DC chopper fed controller. Unlike traditional electronic fan regulator, proposed method feeds the current continuously to the load. Thereby it reduces the speed ripples of the motor. Also FFT results suggests that the input, output current and voltage harmonics are significantly less in the proposed method compared to traditional electronic fan regulator.

Since the production cost of the proposed fan regulator is around Rs. 1870/= (2021 figure), and it involves smart remote controlling facility, the prototype can also be developed as a market competitive product.

Keywords: Ceiling Fan, Fan Regulator, Harmonics, PWM, Speed Ripples

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DEDICATION

Thank you

for your kind affection towards me and all your sacrifices.

Dear Amma and Appachchi,

I would like to dedicate my dissertation

with heart full of happiness to you.

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LIST OF ABBREVIATIONS

Abbreviation	Description
MOSFET	Metal Oxide Semiconductor Field Effect Transistor
FFT	Fast Fourier Transform
IDE	Integrated Development Environment
PWM	Pulse Width Modulation
ISR	Interrupt Service Routine
IGBT	Insulated Gate Bipolar Transistor
RMS	Root Mean Square
PCB	Printed Circuit Board
ESR	Equivalent Series Resistance
EFR	Electronic Fan Regulator
FR	Fan Regulator
SMD	Surface Mount Device
SMPS	Switching Mode Power Supply
AC	Alternating Current
DC	Direct Current
Hz	Hertz
DIAC	Diode for Alternating Current
TRIAC	Triode for Alternating Current
IR	Infrared
CAD	Computer Aided Design

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