شبكة المعلومات الجامعية

بسم الله الرحمن الرحيم

Ain Shams University Information Network

جامعة عين شمس

شبكة المعلومات الجامعية

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شبكة المعلومـــــات الجامعية

التوثيق الالكتروني والميكروفيلم

شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الالكتروني والميكروفيلم

قَســــم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأفلام قد اعدت دون آية تغيرات

يجب أن

تحفظ هذه الأفلام بعيداً عن الغبار

في درجة حرارة من 15 – 20 مئوية ورطوبة نسبية من 20-40 %

To be kept away from dust in dry cool place of
15 – 25c and relative humidity 20-40 %

بعض الوثائق

الأصلية تالفة

بالرسالة صفحات

لم ترد بالأصـــــل

MENOUFIYA UNIVERSITY
FACULTY OF ENGINEERING- SHEBIN EL- KOM
DEPARTMENT OF ELECTRICAL ENGINEERING

CONTROL OF LOAD VOLTAGE USING MICROPROCESSOR

A THESIS SUBMITTED BY

Eng./ ZEYAD MOHAMED REZK
B.Sc. (Eng.) 1992

For the Award of the Degree of
M.Sc. In Engineering

In
" ELECTRICAL ENGINEERING"

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1998

CERTIFICATE

I certify that this work has not been accepted in substance for any academic degree and is not being concurrently submitted in candidature for any other degree.

Any portions of this thesis for which I am indebted to other sources are mentioned and explicit references are given.

ZEYAD REZK

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Z.M. REZK

ABSTRACT

A-C choppers or ac voltage controller have been widely used to obtain variable a-c voltage from a fixed a-c source. A-C choppers are widely used in applications such as industrial heating, lighting control, soft starting of induction motors, speed controllers fans and pumps. Many of these are conventional phase-controlled a-c voltage controllers using thyristors, which have the advantages of simplicity of the control circuit and large power capability. However, these have the inherent drawbacks that power factor decreases when the firing angle increases and that, Since the content of the line current harmonics is relatively large. The size of the passive filter circuit becomes bulky. These drawbacks can be overcome by using PWM a-c chopper.

This chopper offers several advantages such as sinusoidal input current with unity power factor, fast dynamics, and significant reduction in filter size. Some of PWM a-c chopper that has been used is symmetrical angle control, asymmetrical angle control and high-frequency time ratio control. The developments achieved in the field of power electronics made it possible to improve the performance of electrical system utilities. Usually solid state power switching devices are employed in source conditioning by changing either its magnitude or frequency such as converter, inverters, choppers,

or cycloconverters. An a-c voltage controller is used as one of the power electronics systems to control an output ac voltage for power ranges from few watts up to fractions of mega watts. Phase-angle microprocessor based harmonic elimination in chopper type ac voltage controller is used . In this type of controller, output voltage is controlled by varying the ON/OFF time ratios of a series controlled switch using a microprocessor as a controller makes it possible to vary firing instants according to a predetermining firing instants such that selected dominant lower order harmonics can be eliminated. This in turn leads to improve system power factor and efficiency.

In this thesis, a PWM ac chopper harmonic elimination technique is used. For a half cycle of the a-c source, a PWM switching function composed of M' pulses is assumed. Fourier coefficients of PWM output voltage are then obtained, which are expressed in terms of the M' switching point variables. In addition, the constrains for required output fundamental voltage and elimination of harmonics up to $2M'$-1 order, yield M' equations. Solution of these Equations enables the derivation of the required PWM switching pattern for the chopper . Only two MOSFET's controlled by a microprocessor are used to achieve PWM technique for an a-c chopper. Different R-L loads are used in this system. Practical verification of the theoretical predictions is presented.

List Of Symbols

t	Instantaneous time.
$t_1,t_2,t_3,t_4,t_5,\ldots$	Time instants.
T	Time period of carrier signal.
M	Modulation index.
ω_m	Angular frequency of modulating signal.
t_p	Width of modulated pulse.
ω_n	Weighting factor.
WDF	Weighting distortion factor.
ω	Angular frequency.
R	Resistance of the load.
L	Inductance of the load.
F	Frequency.
Φ_o	Phase angle of load current.
Φ_s	Phase angle of supply current.
Φ_r	Phase shifting angle.
v_0,V_0	Instantaneous and peak values of load voltage.
v_s,V_s	Instantaneous and peak values of supply voltage.
i_s, I_s	Instantaneous and peak values of supply current.
i_0,I_0	Instantaneous and peak values of load current.

D1,S1,G1	Drain, Source and Gate of main MOSFET.
D2,S2,G2	Drain, Source and Gate of freewheeling MOSFET.
Φ_{rn}	Phase angle for voltage component of order n .
SW1	Main switch connected in series with the load.
SW2	Freewheeling switch connected in parallel with the load.
V_n	Voltage for harmonic of order n.
$\alpha_1, \alpha_2, \alpha_3, ...$	Switching angles.
2P	Number of switching angles per half cycle.
V_{ll}	Lower limit for the fundamental output voltage.
V_{U1}	Upper limit for the fundamental output voltage.
V_1	Fundamental output voltage.
$M^{\cdot}$	Number of pulses per half cycle.
X_0	Switching function.
Φ_{r1}	Phase angle of the fundamental output voltage.
K	Ratio between peak value of fundamental load voltage component to peak value of input supply voltage.
Z	Load impendence.
E	Inverter output voltage.
M1	Highest order harmonic.

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