SOME ASPECTS OF THE EFFECT OF D.C. OFFSET VOLTAGE CONTROL ON NATURAL COMMUTATED CYCLOCONVERTER

By

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CERTIFICATE

Certified tht the thesis entitled "**Some Aspects of the Effect of D.C. Offset Voltage Control on Natural Commutated Cycloconverter**", which is being submitted by Alok Prakash Mittal in fulfilment of the Degree of Doctor of Philosophy in Electrical Engineering of the Indian Institute of Technology, Delhi, is a record of the work carried out under my guidance and supervision. The matter embodied in this thesis has not been submitted for the award of any other degree or diploma.

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ABSTRACT

The natural commutated cycloconverter due to its natural ability of commutation is found suitable for static variable speed constant frequency generation. In the present work the effects of offset voltage control technique are studied on the performance of the cycloconverter operating in circulating current mode. The offset voltage control technique has been found to be effective in reducing the weight of the circulating current limiting reactors. In VSCF generation schemes, since the weight of the power supply is of prime importance, it is attempted to reduce the weight of the reactors by developing reactor design strategies.

The effect of offset voltage on the input current of the cycloconverter has been studied in detail. It has been shown that the input displacement factor of the cycloconverter improves with offset voltage control, when the cycloconverter is operating in circulating current mode.

The main problem of the cycloconverter is the presence of low frequency oscillations (also known as amplitude modulation) in the output voltage waveform. The regular sampling technique used in the present studies results in

lesser magnitude of these oscillations in the cycloconverter output voltage. The effect of offset voltage on the amplitude modulation has been investigated. It has been observed that the amplitude modulation is minimum at a particular offset voltage level.

The above studies of input current and amplitude modulation are carried out theoretically, using a computer simulation procedure, as well as experimentally. A microprocessor based trigger controller for the cycloconverter has been developed for experimental studies. The unique feature of the microprocessor scheme is the use of less hardware circuitary. It has been achieved by developing a structured algorithm for controlling the trigger angles of the cycloconverter.

LIST OF SYMBOLS

α	Trigger angle
Δ	Offset angle
μ	Commutation overlap angle
f	Frequency
p	Pulse Number of the cycloconverter
r	Modulation Index
L	Inductance
v_A, v_B, v_C	Phase voltages of the supply
v_o	Output voltage of the cycloconverter
v_{dc}	Output voltage of the dual converter
V_{ref}	Reference voltage
V_{off}	Offset voltage
A_n, B_n	Harmonics
i	Instantaneous current
I	r.m.s.current
j	Sampling pulse number
θ_o	Arbitrary delay angle
ϕ_o	Phase angle
ω	Angular frequency
K	Constant
N	Reactor coil turns
A	Reactor cross sectional area
l	Reactor flux path's length
B	Flux density
W	weight of reactor
q,s	Coefficients representing effect of offset voltage

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