

MICROPROCESSOR CONTROL OF THREE-PHASE CYCLOCONVERTER:  
INVESTIGATIONS ON DESIGN, IMPLEMENTATION AND PERFORMANCE

by

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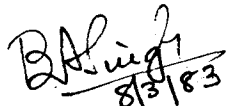
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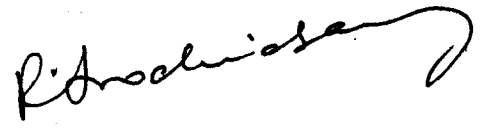
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CERTIFICATE

Certified that the dissertation entitled  
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which is being submitted by Nalin Kant Sharda in fulfilment  
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Electrical Engineering of the Indian Institute of Technology,  
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the award of any other Degree or Diploma.

  
(B.P. Singh)

  
(R. Arockiasamy)

March 1983.

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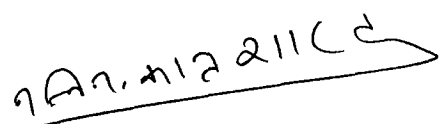
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## ABSTRACT

The naturally commutated cycloconverter is used in speed control of A.C. machines and in the variable speed constant frequency (VSCF) power supplies. Over the years, its control circuits have been designed with vacuum tubes, transistors and integrated circuits. Today the microprocessor makes much more computational and logical power available in much less space and cost. Efforts towards the use of the microprocessor for controlling cycloconverter have already been reported (in references /18-20/). Due to the sequential action of the microprocessor shortage of real-time is encountered for three-phase cycloconverter control. To overcome this shortage of real-time, some approximations have been suggested in two of these works /19,20/. Moreover, quantitative data on the accuracy of trigger timing produced on a microprocessor based system are not available. The aim of this research work is to investigate techniques for implementing the accurate method of generating trigger pulses for a cycloconverter on a single-processor based system, and to obtain quantitative data on the accuracy with which these trigger pulses can be generated.

The three-phase to three-phase three-pulse cycloconverter has been used in this work. The microprocessor

system has been based on the 8085 processor. A complete system has been built for practically implementing two techniques developed for cycloconverter control. Each technique is tested qualitatively by observing the cycloconverter waveforms produced by it. For quantitative testing, first, the theoretical trigger timings are found by a digital computer simulation of the cycloconverter. These timings are then compared with those obtained on the microprocessor based system. The spectra of the cycloconverter waveforms produced by the two techniques are finally recorded and compared.

Concepts of structured programming have been used in writing the trigger programs. Overall programming effort has been reduced by writing modular programs.

In this work it has been shown that an 8-bit system suffices for cycloconverter control. For improving the trigger system performance, timing bottlenecks need more attention. One of the techniques developed overcomes these timing bottlenecks, but with reduced speed of response to change in cycloconverter parameters. Another technique has been suggested for further improvement in the performance of the trigger system.

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