SINGLE RESISTANCE CONTROLLED OSCILLATORS

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A thesis submitted to the
Indian Institute of Technology, Delhi
for the award of
DOCTOR OF PHILOSOPHY

DEPARTMENT OF ELECTRICAL ENGINEERING
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NEW DELHI - 110016

DECEMBER 1982

Dedicated

To

my Late father

Shri V.G. SASTRY

C E R T I F I C A T E

This is to certify that the thesis entitled, "SINGLE RESISTANCE CONTROLLED OSCILLATORS" being submitted by V. Prem Pyara, to the Department of Electrical Engineering, Indian Institute of Technology, Delhi, for the award of the degree of Doctor of Philosophy, is a record of bonafide research work carried out by him under our supervision and guidance and in our opinion, it has reached the standard fulfilling the requirements of the regulations relating to the degree.

The results contained in this thesis have not been submitted to any other institute for the award of any degree or diploma.

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ACKNOWLEDGEMENT

It is a pleasure to acknowledge my thankfulness to Professor S.C. Dutta Roy and Dr. S.S. Jamuar, my supervisors, for their able guidance during the course of this research work. The ideas and suggestions of the former, coupled with the constant encouragement from the latter, have seen to the successful completion of this work.

Amongst others who have indirectly contributed to this thesis, I would like to make a special mention of my grand parents, mother and sisters; the understanding and affection shown by them during the course of this work has gone a long way towards the completion of this work.

I wish to thank my colleagues, Dr. Anil Mahanta, Dr. K. Sudhakar and Dr. V.C. Das for their helpful attitude during the course of this dissertation.

- V. Prem Pyara

ABSTRACT

This thesis presents some new results on the synthesis and design of single resistance controlled oscillators (SRCOs). In particular, systematic procedures for identification, synthesis and design of the second order SRCOs are proposed, and a number of new SRCO circuits are derived therefrom. To start with, a network synthetic approach to SRCO design is proposed, which aims at reducing the number of operational amplifiers (OAs) in a given SRCO (called the prototype) to just one, while maintaining the single resistance controllability. It is shown that this can be done in a number of ways, resulting in a number of new SRCO circuits which operate in the same frequency range as the prototype. Using lowpass to highpass frequency transformation and a network transformation, a few more SRCO circuits, which operate in the complementary frequency range of the prototype and in the same frequency range as well, are derived.

The network synthetic approach essentially optimizes the prototype circuit in respect of the number of OAs. A unified approach for the identification and design of single-OA-based SRCOs has been proposed in this thesis, using which, a number of SRCO circuits, canonic with respect to the number of capacitors have been identified.

A detailed analysis of the SRCO circuits obtained from the two approaches has been carried out, and performance and limitations of the various circuits have been studied, theoretically as well as experimentally. Finally, the thesis presents a new active-R SRCO, which has been derived through a simple extension of the network synthetic approach. The circuit requires two dominant-pole compensated OAs and few resistors for its realization. As the circuit utilizes the OA's internal capacitor, its frequency range extends beyond that of active -RC oscillators. More than a decade of frequency variation is obtained in this SRCO.

C O N T E N T S