



شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم

بسم الله الرحمن الرحيم



HANAA ALY



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Cairo University

APPLICATIONS OF FRACTIONAL ORDER ELEMENTS AND MEM-ELEMENTS IN ELECTRONIC CIRCUITS

By

Nariman Abdo Khalil Hussein

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
DOCTOR OF PHILOSOPHY
in
Electronics and Communications Engineering

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
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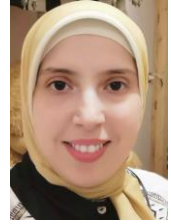
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Title of Thesis:

Applications of fractional order elements and mem-elements in electronic circuits

Keywords:

Fractional order elements emulator; Fractional order memelements emulator; Fractional filter and inverse filter; Chaotic system

Summary:

This work aims to apply the fractional-order elements and mem-elements in analog circuit design. A general prototype fractional-order filter based on a two-port network concept with four external impedances is investigated. Ten possible generalized topologies are introduced where the necessary network conditions and the critical frequencies are presented. Besides, a generalized prototype topology of fractional order inverse filters (FOIF) is presented based on operational trans-resistance amplifiers and second-generation current conveyor. The fractional-order parameters increase design flexibility and controllability, which is validated experimentally. The fractional-order systems are extended to memristive element modeling. The realization of grounded and floating fractional-order mem-elements (FOMEs) using the generalized emulator. Two- and three-port mutators are used to realize different FOMEs employing different combinations of impedances. The FOMEs are applied to Chau's circuit showing the effect of fractional-order on the chaotic behavior. Circuit simulations and experimental results for the presented circuits are introduced to validate the theoretical findings.

Disclaimer

I hereby declare that this thesis is my own original work and that no part of it has been submitted for a degree qualification to any other university or institute.

I further declare that I have appropriately acknowledged all the used sources and have cited them in the reference section.

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Acknowledgements

First of all, my thanks go to the members of the examining committee for reading my thesis and their interest in my research.

I would never have been able to successfully finish my dissertation without first the guidance of my advisors and second the support and help from my family.

I would like to express my deepest gratitude to my advisors, Prof. Ahmed Mohamed Soliman, DR. Ahmed Gomaa Radwan, and DR. Lobna Ahmed Said for their excellent guidance and their continuous support of my PhD study. Without their help and advice, I would not be able to write this thesis.

I would like to thank M. Abdel Aziz, M. Amr Mabrouk, and all NISC members for helping me to finalize this work.

I would also like to deeply thank my parents, and my brothers. They were always supporting me and encouraging me with their endless love.

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