

ACCURATE RATIONAL TWO-PORT MODELING OF PASSIVE AND ACTIVE
DISTRIBUTED PARAMETER STRUCTURES

A dissertation
submitted for the degree of
DOCTOR OF PHILOSOPHY
in Electrical Engineering

by

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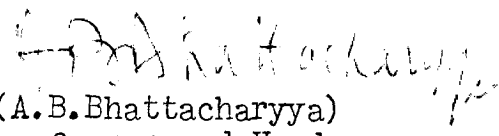
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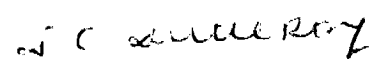
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CERTIFICATE

This is to certify that the dissertation,
'Accurate rational two-port modeling of passive and active
distributed parameter structures', which is being submitted
by Umesh Kumar for the award of the degree of Doctor of
Philosophy to the Indian Institute of Technology, New Delhi,
is a record of bonafide research work, carried out under
our guidance and supervision.

This dissertation has reached the standard fulfilling
the requirements of the regulations relating to the degree.
The results obtained in this dissertation have not been
submitted to any other University or Institute for the
award of any degree or diploma.


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ABSTRACT

The thesis is concerned with the synthesis of lumped, single section, accurate and rational two-port circuit models for passive and active distributed parameter networks.

In this dissertation, the passive distributed parameter structures considered are the uniformly distributed $RC(\overline{URC})$ structure, a special class of tapered distributed structures and the distributed $RC(\overline{RC})$ notch filter. The active distributed parameter structure considered is the Metal Oxide Semiconductor Field Effect Transistor (MOSFET).

A generalized modeling technique through a new approximation method for transcendental functions viz. the continued fraction expansion (CFE) and truncation scheme, is presented. The utility and applicability of the technique is established through several illustrative examples.

Modeling of the $\overline{URC}$ structure is presented in the first instance. Rational and precise approximations to the y-parameters, which are complex irrational functions of the complex frequency variable s , are developed through the postulated technique wherefrom an accurate, two-port model is obtained. For computer aided design (CAD) purposes, a controlled source equivalent of the model is also given. The technique is extended to model a special class of nonuniform distributed lossless

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and RC transmission lines characterized by a similar set of immittance parameters. Also modeling of distributed RC ($\overline{RC}$) notch filters including the important effect of parasitics is achieved in the same fashion.

MOSFET modeling in the unsaturated mode is carried out by regarding its channel as a cascade of four equal length $\overline{URC}$ sections. Also the dynamic response of MOSFET charge control model is improved considerably by modifying the charge control equations through inclusion of the intrinsic associated time delays during channel formation.

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