

Supplementary

A Genetic Algorithm for Impedance Matching Network Design

Supplementary material for the final year project report
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The author wishes to thank Dr. P. L. D. Abrie for his guidance and support throughout the project.

by

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A large number of tests were performed to determine the optimum parameters, and

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algorithm and program was developed to optimise the design over the no-frequency range.

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over the no-frequency range. This is a very difficult task, as each method has its own strengths and weaknesses.

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By *Warren Paul du Plessis*
about to *submit my thesis*

Summary

Keywords: Impedance matching, matching network, genetic algorithms, evolutionary computation, messy genetic algorithm, optimisation algorithms, microstrip, microstrip discontinuity, Pareto optimality, multi-objective optimisation

This dissertation considers the development of a new impedance matching algorithm. The main objectives were to develop an algorithm that has similar performance to published results, while overcoming the limitations of published algorithms.

This was achieved by using a genetic algorithm as the basis for the impedance matching algorithm. A number of modifications were made to the genetic algorithm to improve its performance. These modifications include the integration of a local optimiser, the use of Pareto optimality to simultaneously design networks of varying lengths, and the use of both binary and floating-point genetic operators.

The algorithm allows lumped, mixed, and distributed matching networks to be developed. The transmission line elements can either be perfect transmission lines or microstrip lines with both dispersion and discontinuities taken into account. Both the characteristic impedance and length of transmission lines are modified – something that other algorithms cannot do.

A large number of tests were performed on the algorithm to show the effects of the algorithm parameters, and to quantify the algorithm's performance. Comparisons between the new algorithm and published results show that the current algorithm has significant advantages over the real-frequency techniques, although it is not quite as good as the transformation-Q method. This is compensated for by the fact that this algorithm is more versatile than these methods.

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1.3 Motivation

A large volume of research has been devoted to the problem of finding the best circuit for a given function. There has to be some criteria for what "best" means, and this can vary from one application to another. The motivation for this thesis is the need for a better understanding of the relationship between the number of nodes in a circuit and its complexity. This is important because it is often the case that a circuit with a small number of nodes is more difficult to understand than one with a large number of nodes. In addition, it is very important to have a good understanding of the behavior of a circuit under different conditions, such as different input values or different operating conditions. This is particularly true for digital circuits, which are used in many applications where reliability and performance are critical factors.