A Genetic Algorithm for Impedance Matching Network Design

by

Warren Paul du Plessis

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Supervisor: Professor P. L. D. Abrie

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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