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Application of the GAES Fitting Method for Determining Parameter Values of Cauer Multi-Branch Circuits

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Abstract. Fitting methods are based on optimization techniques. These methods find wide application in the process of designing new systems and devices as well as redesigning existing ones. In the publicly available literature, a significant number of matching methods can be found, including both proprietary and widely known and used algorithms, contained in commercial software such as Matlab, Scilab, and CST Studio Suite [1]. Among the commonly used methods, the most popular are those based on genetic algorithms [2, 3] or optimization methods based on the behavior of various species of animals and insects [4, 5, 6, 7, 8]. Unfortunately, most optimization methods are usually applied to solving problems with a small number of decision variables. For more complex optimization problems, an approach combining elements of evolution strategy (ES) with the genetic algorithm (GA) method is much more frequently used [9, 10]. In this work, the authors, due to the consideration of tasks aimed at finding the extremum not only of a multimodal function but also of a function with many variables, utilized a method combining elements of evolution strategy with the genetic algorithm, i.e., the GAES method. The developed method was used to determine the parameters of Cauer multi-branch circuits. The proposed method allows for the search not only for functions of many variables but also for the values of these variables in a complex form. The authors introduced a number of modifications to the basic GAES method, including a proprietary procedure that enables the gradual narrowing of the search area and, to avoid the method getting stuck in a local extremum, deliberately introduced a proprietary operator called " infusion of fresh blood." This operator allowed the authors to "steer" the decision variables of the function out of a local minimum and enabled finding the global minimum. The article presents the proposed method and its implementation in searching for the parameters of Cauer multi-branch circuits. The correctness of the applied method was verified and the obtained results were compared with the results obtained based on the field model.

Keywords: Fitting Method, Genetic Algorithm, Evolutionary strategies, Cauer multi-branch Circuits.

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Author: Dr KURZAWA, Milena (Poznan University of Technology)

Co-authors: IDZIAK, Paweł (Poznan University of Technology); Prof. WOJCIECHOWSKI, Rafał (Poznan University of Technology)

Presenter: Dr KURZAWA, Milena (Poznan University of Technology)

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