An Overview of the Recent Developed MSDES Software used in Distributed Microstrip Circuit Design

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Abstract: **The aim of this paper is to present the author recent development Software program used in the design of distributed Microstrip Circuits. The designed circuits are analyzed using the recent ADS program. The paper demonstrates the design and analysis of Microstrip amplifiers and oscillators designed at frequency 2.4 GHz in addition with design and analysis of rectangular branch line couplers (one-section and two-section), Ring Couplers and Wilkinson couplers. The ADS layouts and the applications of the designed Microstrip Circuits are presented.**
Keywords: **Microwave Circuits and systems, Computational Microstrip Circuit Design, Microwave Circuits analysis.**

I. INTRODUCTION

Since the mid-1970s, a number of computer programs for microwave circuit design had become commercially available. Some well-known microwave computer-aided engineering software packages are SUPER COMPACT [1], TOUCHSTONE [2], and others. All of these programs have certain advantages and some disadvantages.

In this paper we introduce the recent version of our previous [3] computational programs, named HHSS4. In the comparison with the last versions, the additional features summarize as: 1) It covers a wide range of applications in the design of Microstrip passive/linear active microwave circuits, 2) It is an easy-to-use user-oriented program. 3)The output data are formatted and stored in the output files for each application. 4) The program results can be utilized in many programs analysis packages such as PSPICE, MCAP, modified MCAP, CNL2, Super Star... etc. 5) It does not need a high memory size and it can be used in XT, or AT PC computers. 6) The program can be modified for use in the design of nonlinear microwave circuits. This will be the subject of future work.

II. GENERAL DESIGN METHODOLOGY OF THE PROGRAM

The general design methodology of the program is [9-11]:

- Depending on the type of the circuit (active or passive) and the internal parameters of the specified circuit, the software displays all the required parameters that can be specified by the user.
- The substrate parameters of the Microstrip (H, ε_r, and T) are given as common parameters. If the user needs to change these parameters, the software can interact with him/her to enter the new substrate parameters.
- The software can interact with the user for some selections and assumptions inside the specified circuit such as the number of sections in Lowpass filter, or rectangular branch coupler, and the bandwidth of the Wilkinson hybrid.
- After the entry of all parameters required by the user for the specified circuit design, the software performs a complete analytical design with appropriate lengths and widths of the Microstrip lines of the designed circuit.
- The software introduces an optimum selection of circuit elements to fulfill some requirements. These requirements include: i) unconditional stability, ii) potential unstability, iii) simultaneous conjugate match, iv) changing the transistor stability, v) feedback circuit parameters to maximize S_{11}, vi) optimum termination for the output circuit to get the maximum output power, and vii) optimum selection of S-parameters (with the optimum feedback stubs at different frequencies or cascaded resistors) to achieve the transistor changes from unconditional stability to potential unstability and vice versa.

III. PROGRAM DESCRIPTION

It is a user-oriented CAD program used for a wide range of Microstrip applications [12-15,30]. It can be used for active and passive circuits design such as Microstrip amplifiers, oscillators, couplers, and mixers. The program entries are: 1) substrate parameters: relative permittivity (ε_r), substrate height (h), conductor thickness (t), and characteristic impedance of the

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