

Contribution à la modélisation de structures et dispositifs passifs microondes basée sur l'utilisation de différentes techniques d'optimisation : Application aux filtres en guides d'ondes rectangulaires métalliques

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Abstract: In this work, we proposed a method for the synthesis of hollow waveguides filters. It consists of a combination of several calculations, simulations and optimizations techniques classified in a defined order to result in band-pass filters. It is a question of: First, to generate the coupling matrix starting from the filter specifications. Deduce the equivalent circuit and then convert it into a microwave structure, which consists of replacing the resonators and inverters of the circuit by resonant cavities and couplers. Once the circuit has been converted to a microwave structure, we need an analysis method to ensure the right conversion. For this, we used the segmentation method, which consists in fragmenting the structure into several basic elements (junction, bend and T-junction). Each element is analyzed separately using the mode-matching method, and then the structure is assimilated to a network made up of these basic elements. Since the final result requires optimization because it does not correspond perfectly to the specifications of the structure to be synthesized, we have studied and used three optimization techniques: genetic algorithms, particle swarm optimization and neural networks. To validate our synthesis method, we have successfully applied it to the synthesis of the Tchebychev, Dual-mode, and generalized Tchebychev band-pass filters.

Keywords : filter, waveguide, Coupling matrix, Mode-matching, Segmentation method, Optimization techniques.