

# Fast Waveguide Filter Synthesis, using the Mode Matching Method for Analysis and Practical Swarm Optimization

**Said Zouhdi, Hamid Al-Naimiy**

**Abstract :** In this paper, we give two examples of rectangular waveguide bandpass filter synthesis. Starting from the filter specifications (order of the filter, position of zeros, band-edge frequencies, and passband return loss) our aim was to realize one program that makes all steps of the filter synthesis (calculate the coupling matrix, create the equivalent circuit, convert the equivalent circuit to waveguide structure, analyze this structure, and then optimize its dimensions), and doing this as fast as possible (less than two minutes). For the coupling matrix we used the Atia and Williams's method, for the analysis we used the mode matching method, which is the most adequate for this kind of structures, and for the optimization we used the Practical Swarm Optimization PSO. The complete combination has been successfully applied for several waveguide filters synthesis.

**Keywords :** waveguide bandpass filter, Practical Swarm Optimization, mode matching