

Design of Microwave Building Block by Using Numerical Search Algorithm

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Abstract : With the development of technology, countries gradually allocated more and more frequency spectrums for civilization and commercial usage, especially those high radio frequency bands indicating high information capacity. The field effect becomes more and more prominent in microwave components as frequency increases, which invalidates the transmission line theory and complicate the design of microwave components. Here a modeling approach based on numerical search algorithm is proposed to design various building blocks for microwave circuits to avoid complicated impedance matching and equivalent electrical circuit approximation. Concretely, a microwave component is discretized to a set of segments along the microwave propagation path. Each of the segment is initialized with random dimensions, which constructs a multiple-dimension parameter space. Then numerical searching algorithms (e.g. Pattern search algorithm) are used to find out the ideal geometrical parameters. The optimal parameter set is achieved by evaluating the fitness of S parameters after a number of iterations. We had adopted this approach in our current projects and designed many microwave components including sharp bends, T-branches, Y-branches, microstrip-to-stripline converters and etc. For example, a stripline 90° bend was designed in 2.54 mm x 2.54 mm space for dual-band operation (Ka band and Ku band) with < 0.18 dB insertion loss and < -55 dB reflection. We expect that this approach can enrich the tool kits for microwave designers.

Keywords : microwave component, microstrip and stripline, bend, power division, the numerical search algorithm.

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