# LOSSLESS IMPEDANCE MATCHING OPTIMIZATION FOR INCREASING BANDWIDTH OF ANTENNAS

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In the design of RF radiators, impedance matching has been costing a significant amount of time and energy. Approaches to solve impedance matching problems mainly rely on computer-aided numerical optimizations, nowadays. An approach based on the MATLAB Global Optimization Toolbox™ is proposed in this paper. This approach combines brute-force techniques and the Real Frequency Technique, which are the two main components of modern impedance matching methods.

The proposed approach allows the designer to choose a desired circuit topology, and use actual measurement impedance data from a candidate high-frequency (HF) dipole antenna to get the optimum matching network. After comparing the performance of three algorithms – the genetic algorithm, the pattern search, and the simulated annealing algorithm - at a single frequency, the simulated annealing algorithm is adopted as the solver in the Global Optimization Toolbox™. Four combinations of inductor and capacitor lumped loads (L only; C only; LC in series; and LC in parallel) are filled in topology blank boxes, and then the optimizer compares all possibilities and presents the best matching network result. In each optimizer, the simulated annealing algorithm is run for a number of loops, comparing the results and picking the best set as the return optimized value.

The Global Optimization Toolbox™ from MATLAB is the main software tool used in this paper. The results are presented respectively for an L network, a T network, a Pi network, and 5-element and 6-element network topologies. The bandwidth with a Voltage Standing Wave Ratio (VSWR) of 2:1 can be increased from 3.4% to at least 14.4% after the optimization; the bandwidth with a VSWR of 1.5:1 can be increased to 10.9% after the optimization.