OPTIMIZATION OF EBG STRUCTURES BY USE OF GLOBAL OPTIMIZATION ALGORITHMS

J. Horák, L. Oliva, Z. Raida
Ústav radioelektroniky, VUT v Brně,
Pukryňova 118, Brno, 612 00, Czech Republic

Dielectric electromagnetic bandgap structures (EBGs, photonic crystals) are periodic dielectric structures preventing electromagnetic wave propagation in some band. They enable to design reflectors, resonators or to suppress surface wave on the planar antennas. The article presents way of the planar EBG design for planar antennas design by use of global optimization algorithms.

Planar dielectric EBG structures are formed by two-dimensional periodic dielectric inclusions in the dielectric slab. The main design parameters forming the frequencies of stopband are the shape of inclusions and their size, kind of slab it is formed in, lattice constant and both slab and inclusions permittivity. While there does not exist a general way how to determine the stopband existence of certain parameter setup analytically it must be simulated by use of numerical methods.

To be able to reach the best performance in such nonlinear optimization problem, two algorithms – Particle Swarm optimization and Genetic algorithms applied to the problem of the multiple bandgaps fitting to the planar patch antenna will be presented. MATLAB is there used as tool to design both global optimization algorithms while the calculations are done by freely available simulation tool. The results verification and the final patch design are done in CST Microwave Studio. The whole procedure is intended to serve as practice in the antenna design course on our department.

Contacts: J. Horák (xhorak23@stud.feec.vutbr.cz), L. Oliva (xoliva02@stud.feec.vutbr.cz), Z. Raida (raida@feec.vutbr.cz)