

## Modeling of photonic crystals waveguides

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Photonic crystals (PhC) or photonic bandgap (PBG) structures and photonic structures based on them represent nowadays very promising structures of artificial origin. Since they exhibit very specific properties and characteristics that can be very difficult (or even impossible) to realise by other means, they represent a significant part of new artificially made metamaterial classes. Clearly, development and testing of numerical modeling tools on one side, and analysis and design of novel perspective PhC-based structures on the other side, are strongly interconnected.

For studying and modeling properties of PhC structures, we have applied, implemented and partially improved various complementary techniques: the 2D plane wave expansion (PWE) method, the 2D finite-difference time-domain (FDTD) method with perfectly matched layers, the differential form of the transfer matrix method (TMM), and recently also aperiodic rigorous coupled wave analysis (ARCWA) technique. Also, together with these in-house methods, other tools available in the field have been applied, including, e.g. MIT MPB (PWE), F2P (FDTD), and Translight (TMM) packages.

We have applied these methods to several structure examples, studying the effects of varying the key parameters and geometry. Such a study is relevant for proper understanding of physical mechanisms and for optimization and fabrication recommendations. Namely, in this contribution, we have concentrated on several examples of PhC waveguide structure simulations, comparing two types of guides, dielectric-rod type and air-hole type, with several geometries: rectangular lattice with either rectangular or chessboard inclusions, and triangular lattice with circular inclusions. The modeling results are compared and discussed.

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