# BandSOLVE

BandSOLVE is the first commercially available design tool to automate and simplify the modeling and calculation of photonic band structures for all photonic crystal (PC) devices. The BandSOLVE simulation engine employs the Plane Wave Expansion (PWE) algorithm to perform band computations, and also provides a graphical display of the electromagnetic fields and other quantities of interest for further analysis.

## Benefits

⇦⇦Advanced implementation of PWE and FDTD (for FullWAVE users only) algorithms allows for a wide range of simulation and analysis capabilities for different types of PBG devices & materials

⇦⇦Built-in array layout utility as well as layout hierarchy offers a convenient way to create both standard and custom PBG structures

⇦⇦A large number of real application examples

⇦⇦Fully integrated into the RSoft CAD Environment (page 5)

## Applications

BandSOLVE can be used to optimize the band structure of new photonic crystal geometries before fabricating the device and to determine the performance of existing components. BandSOLVE can be applied to a wide range of PC components, including but not limiting to:

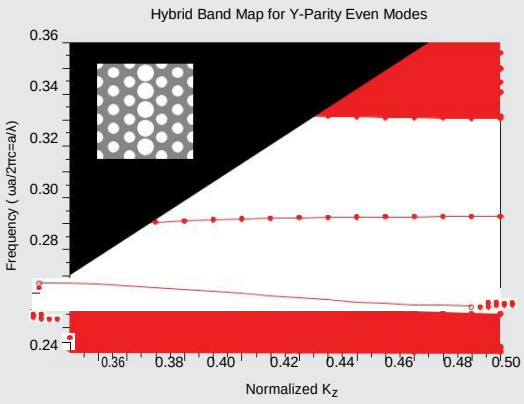
⇦⇦2D and 3D PC slab and waveguides ⇦⇦2D and 3D cavity problems

⇦⇦Photonic crystal fibers, both band-gap guiding and conventional guiding

⇦⇦Defect modes of non-strictly periodic structures ⇦⇦Metallic and anisotropic structures

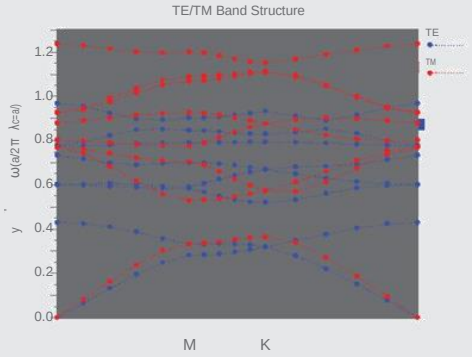
## Featured Application

Band diagram for even modes of a waveguide in a lattice of air holes in a photonic crystal slab as computed by a 3D BandSOLVE simulation. The black area represents the leaky mode region, the shaded red regions represent the slab modes, and the red line represents guided modes in the waveguide. The waveguide was formed by enlarging one row of holes as shown.

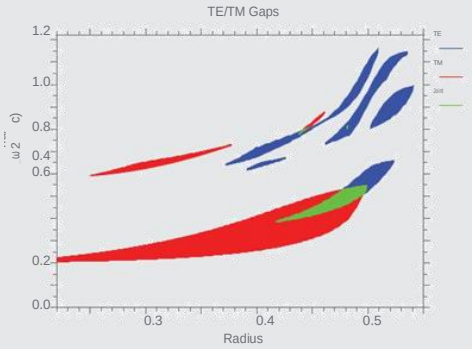


## Features

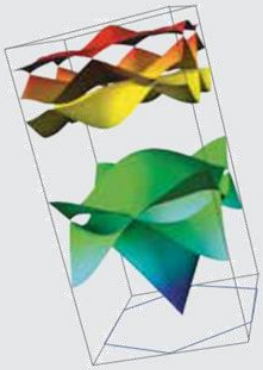
- Employs a very efficient and robust Plane Wave Expansion (PWE) algorithm that can solve for the band gaps of most 1D, 2D, and 3D PBG devices
- Includes several advanced simulation features for more efficient, fast band computations, such as inversion symmetry, mode seeding, and parity for 3D calculations
- Includes a Finite-Difference Time-Domain (FDTD) engine (for FullWAVE users only) for situations in which the PWE algorithm is not applicable, such as metallic and non-linear systems
- Employs complete and powerful post-processing tools for the calculation of a wide range of data and graphs. BandSOLVE's analysis features include:
  - Band gaps, band maps, and gap maps
  - Mode computation including Bloch and defect modes
  - Wide range of measurements such as effective and group index, group velocity, and dispersion
  - Equi-frequency plots for analysis of the entire Brillouin zone
  - Light cone filters for photonic crystal slab applications
  - Fixed-frequency analysis to incorporate material dispersion




Band structure for a 2D hexagonal lattice of air holes




Band gaps for a 2D hexagonal lattice of air holes vs. hole radius



Band surfaces for a 2D hexagonal lattice of air holes

SEE PAGE 43 FOR SYSTEM REQUIREMENTS