FDTD MODELING OF PHOTONIC CRYSTAL WAVEGUIDES

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Photonic crystals and devices based on them are now of great interest both from the fundamental and applied points of view. We use a finite difference time domain (FDTD) numerical recipe for calculating their transmission-reflection properties in different linear regimes. The original FDTD code ONYX-2 [1] has been modified for 3D calculations by implementing special absorbing boundary conditions – uniaxial perfect matched layers.

A big variety of photonic crystal waveguides (PCW) and optoelectronic components have been modeled in 2D and 3D by the FDTD

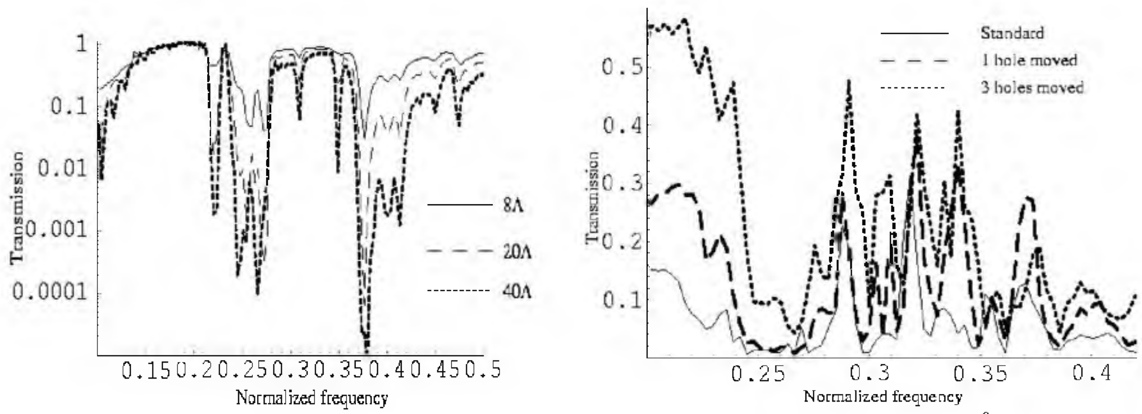

Fig. Transmission spectra for straight PCW (left) and PCW with doubled 60^0 bend.

technique. Waveguides are made by 2D patterning of layered dielectric structure with air holes arranged in triangular lattice. Missing one or more rows of holes organizes a waveguiding defect. Two typical PCW spectra are presented in Fig. The left one is for straight PCWs of different lengths (length is in lattice constant Λ). The attenuation is quite clear seen. Using transmission results propagation losses were estimated on different frequencies. The right figure spectra belong to three-rows missed PCW with double 60^0 bend. Different variants of sharp bends designs optimize the transmission.

For most of the modeled structures – straight PCW, Y-splitters, coupled cavity waveguides, coupled waveguides systems for WDM, etc. a remarkable matching with known experimental and theoretical results has been found.