Photonic crystal waveguides based on surface mode coupling

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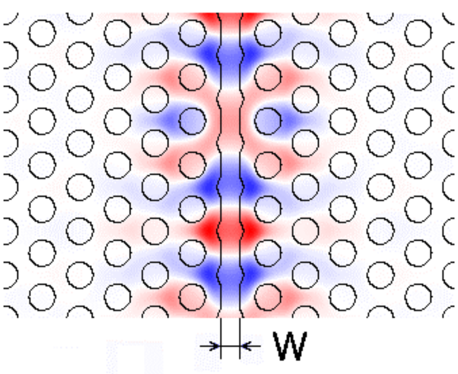
We theoretically investigate photonic crystal waveguide structures based on the coupling between surface modes of identical two truncated PCs using the plane wave expansion method and the finite-difference time-domain method. Coupling of two adjacent surface modes results in even and odd modes[1]. In this study we consider the even modes only due to the symmetry of a Gaussian excitation source[2]. The proposed waveguide structure exhibits high transmittance and large guiding bandwidth, which covers all regions of the band gap with a good dispersive property such as high group velocity. These properties can be controlled by varying the waveguide width **W** defined as the distance between the truncated surfaces. Note that the variation of **W** was achieved by cutting off parts of the adjusted PCs without changing the distance between the PCs. Thus the proposed waveguide can be useful in the implementation of high-density photonic integrated circuits based on the photonic crystal device elements.

(a)



(b)

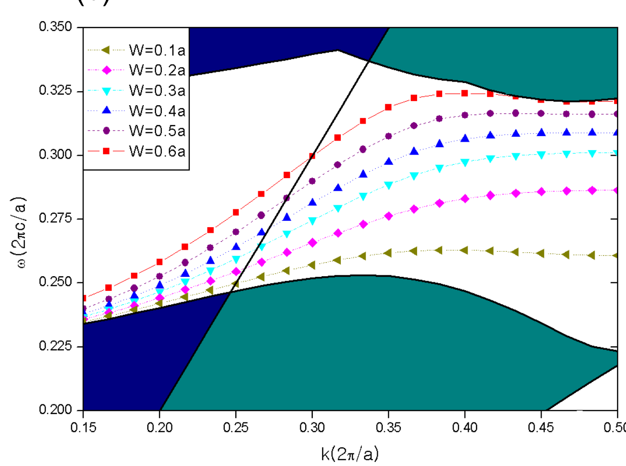


Fig. 1 Spatial distribution of magnetic field of the guided mode at $ka/2\pi = 0.4$ when **W** = $0.4a$, $r = 0.3a$, and $\varepsilon = 8$ (a) and the band diagram when **W** varies from 0.1 to $0.6a$ (b). The straight line denotes the light line of air. .

Reference

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[1] J.A. Gaspar-Armenta, Francisco Villa, F. Ramos-Mendieta, Opt. Commun. **216**, 379 (2003).
[2] Chul-Sik Kee, H.Lim, Jungil Lee, Phys. Rev. B **67**, 073103 (2003).