

Comprehensions on side-coupling characteristics of cavities and waveguides in triangular-lattice photonic-crystal slabs

Guk-Hyun Kim and Yong-Hee Lee
Department of Physics, KAIST, Daejeon 305-701, Korea

The side-coupling between a cavity and a waveguide is an important geometric configuration to construct photonic-crystal-based optical circuits. Using the FDTD method, we investigated side-coupling characteristics between Γ -K directional waveguide modes and various resonant cavity modes in a triangular-lattice photonic-crystal slab. To understand the coupling characteristics systematically, we classified the side-couplings into three following cases based on relative field distributions of cavity and waveguide modes. (1) The cavity mode is donor-type and its decaying Γ -M direction is perpendicular to the waveguide axis (Fig. 1). (2) The decaying Γ -M direction of donor-type mode is not perpendicular to the waveguide axis (Fig. 2). (3) The cavity mode is acceptor-type (Fig. 3). In each case, the coupling characteristics were well described by the simple argument of transverse overlap between cavity and waveguide modes over the waveguide region. We will show the coupling characteristics and the corresponding arguments for various side-couplings. The classification and transverse-overlap argument would be a useful tool to design cavity-waveguide coupled structures in photonic crystals.

