Figure Contents

Fig. 1.1 Schematic drawing of (a) periodic photonic crystals and (b) defect and cavity photonic crystals
Fig. 1.2 The comparison in optical properties between bulk material and photonic band gap material9
Fig. 1.3 The representation of (a) macroscopic and (b) microscopic resonances 10
Fig. 1.4 The advantage and function of photonic crystals on the LED and LD
Fig. 2.1 Schematic illustration of the unit cell construction for the circular dielectric rod
Fig. 3.1 Photonic band structure of circular air rods in the triangular lattice, at a filling factor $f = 0.8$
Fig. 3.2 The schematic drawing of veins and spots in the triangular lattice
Fig. 3.3 Gap widths as a function of filling factor of circular air rods in the triangular lattice
Fig. 3.4 Displacement-field distribution of E-polarization modes associated with (a) first and (c) second bands at $f = 0.3$; (b) first and (d) second bands at $f = 0.85$
Fig. 3.5 Photonic band structure of square air rods in the triangular lattice, at a filling factor $f = 0.8$
Fig. 3.6 Gap widths as a function of filling factor of square air rods in the triangular lattice
Fig. 3.7 Complete gap widths to mid-gap frequency ratio as a function of filling factor for circular or square air rods in the triangular lattice. 43
Fig. 3.8 Photonic band structures associated with (a) circular and (b) square dielectric rods embedded with square lattice, at the filling factor of 0.45. 44
Fig. 3.9 Gap map for the square lattice of (a) circular and (b) square dielectric rods as a function of filling factor
Fig. 3.10 Schematic of oval rods in the triangular lattice.46

Fig. 3.11	Normalized gap width of complete PBG as a function of b_y for various α	1 6
Fig. 3.12	The dependence of gap map on filling factor of (a) $\alpha = 0.75$, (b) $\alpha = 0.85$ and (c) $\alpha = 0.95$	17
Fig. 3.13	The dependence of normalized complete gap width on f for various α through a rotation angle of $\theta = 30^{\circ}$	18
Fig. 3.14	The dependence of gap map on filling factor of (a) $\alpha = 0.8$ and (b) $\alpha = 0.9$ through a rotation angle of $\theta = 30^{\circ}$	19
Fig. 3.15	Gap maps plotted with respect to the (a) filling factor and (b) refractive index for circular dielectric rods in the triangular lattice.	50
Fig. 3.16	The gap map as a function of filling factor of circular anisotropic rods in the triangular lattice	51
Fig. 4.1	(a) the size of side, and (b) the radius of inscribed circle and circumcircle, corresponds to each equilateral polygon with a filling factor of 0.45	54
Fig. 4.2	The photonic band structures associated with (a) circular rods and (b) square rods in the square lattice, at a filling factor of 0.45	55
Fig. 4.3	Gap width as a function of number of side N of equilateral polygon, at a filling factor of 0.45.	56
Fig. 4.4	Field patterns of E-polarization modes inside polygonal rods of (a) N=4 (b) N=5 (c) N=6 (d) N=7 (e) N=8 (f) N=9 (g) N=10 (h) N=11 and (f) circular rod, for the E8 band and at the <i>M</i> -symmetry point.	57
Fig. 4.5	The photonic band structures of polygonal rod of N=12 in the square lattice, at a filling factor of 0.45	58
Fig. 4.6	The photonic band structures for a square lattice of anisotropic (a) circular rods and (b) square rods in air, at a filling factor of 0.45	59
Fig. 4.7	Gap width as a function of number of side N of equilateral polygon, at a filling factor of 0.45.	70
Fig. 4.8 Fig. 4.9	The representation and cross-sectional geometry of the rods 7 Photonic band structures for (a) square rods $(b=0)$ and (b) octagonal rods $(b=15\cdot\beta)$ in the square lattice, at a filling factor	71
	of 0.45	12

Fig. 4.10	The gap map as a function of <i>m</i> , and the corresponding size of cutting corner for each structure is $m \cdot \beta$	13
Fig. 4.11	Field patterns of E-polarization modes inside the dielectric rods	
	of (a) $m=0$ (b) $m=8$ (c) $m=10$ and (d) $m=15$, for the E_8 band and at	
	the <i>M</i> -symmetry point	13
Fig. 4.12	The (a) band center and (b) band width associated with E_8 and E_9 bands as a function of m	14
Fig. 4.13	(a) Band center and (b) band width associated with H ₆ and H ₇ bands as a function of m	15
Fig. 5.1	Schematic configuration of a triangular lattice with hollow oval Te rods)1
Fig. 5.2	The representation of anisotropic optical property)1
Fig. 5.3	Schematic illustration of the unit cell construction for the hollow oval dielectric rod)2
Fig. 5.4	The band structure for a triangular lattice of hollow oval rods at a rotation angle of $\theta_1 = \theta_2 = 0^\circ$	92
Fig. 5.5	The Schematic diagrams of three deformed hollow structures. The structures are deformed by altering the factors α_1 and	
	α_2	13
Fig. 5.6	Gap maps of the (a) structure A, $\alpha_1 = \alpha_2$ (b) structure B, $\alpha_1 = 1$, and (c) structure C, $\alpha_2 = 1$. The major-axis lengths of shell and	
	inner rods are fixed to $\ell_1 = 0.27a$ and $\ell_2 = 0.48a$)5
Fig. 5.7	Displacement-field distribution of E-polarization modes inside the hollow rods in the (a) hollow circular structure, $\alpha_1 = \alpha_2 = 1$ (b) structure A with $\alpha = \alpha = 1.6$ (c) structure B with	
	$\alpha_1 = 1, \ \alpha_2 = 1.6$, and (d) structure C with $\alpha_1 = 1.6, \ \alpha_2 = 1$ at <i>K</i> -symmetry point)6
Fig. 5.8	Schematic configuration of triangular lattice with hollow oval Te rods. The inner rod rotates at an angle of θ_1 . The outer shell	
	rotates at an angle of θ_2 . (a) inner-rod rotation: $\theta_1 = \theta$ and $\theta_2 = 0^\circ$, and (b) whole-rod rotation: $\theta_1 = \theta_2 = \theta$)7
		'

- Fig. 5.13 E1 and E2 gap widths as a function of rotating angle θ_1 for inner rod and whole rod rotations at $\alpha_1 = \alpha_2 = 1.6$ 102