Chapter 5 Conclusion

The omnidirectional band structure $\Omega(K_{//})$ of one-dimensional photonic crystal can be calculated by using plane wave expansion method. In this band structure we can obtain the information of omnidirectional bandgap, which depends on the refractive index contrast of two layers of unit cell. If the index contrast is large enough, the omnidirectional bandgap will exist, thus the 1-D photonic crystal has the ability to exhibit the omnidirectional reflection.

We introduce the method of heterostructure to enlarge the gap width of the omnidirectional reflector, and obtain *3.4* times omnidirectional reflection bandwidth. Further, we design the dichroic beam splitter (BS) by using the same band structure. In order to achieve omnidirectional use of the BS, we present the design step of heterostructure and introduce three-layer unit cell, and we indeed obtain larger working incident angle. By adding the impedance-matching layer, the transmission of allowed wave will be raised, i.e., the ripple effect will be reduced.

In order to predict the transmission and ripples of the allowed band, we form the band structure of finite-sized 1-D PC by transfer matrix method. We can see the various magnitude of transmission on each allowed bands. By observing this band structure, the better performances of our designing devices are discovered. We present the concept of the angular tuning optical switch and obtain many superior performances by using such band structures.

Finally, we apply the optical switch to the lightvalve of display. We further introduce a mirror to reduce half response time of the display, and this metallic mirror can be substituted by the multilayered omnidirectional reflector to enhance the reflectance. Comparing with the projectors, another advantage of our lightvalve is that both polarizations are considered, i.e., the polarizer used in LCD and LCOS will not be needed. Thus, this lightvalve will have potential to compete with other projectors, and other multilayered optical devices designed from omnidirectional 1-D PC will be usefully applied to optical systems.