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(Vipin Kumar)
During the past two decades, light propagation in complex structures has aroused considerable interest of many investigators. Early work of Yablonovitch and his co-workers and also by S. John stimulated tremendously the interest of many researchers, who suggested that diffraction by periodic structures might lead to a ‘photonic insulator’ in which propagation of light is forbidden in a certain range of frequencies. These photonic insulators are known as Photonic Band Gap (PBG) structures have a large number of applications in the field of photonics and integrated optics. Many applications in optics and microwaves are emerging by using the concept of PBG materials and structures. This new exciting structures and materials are currently under investigation in many laboratories worldwide.

The possibilities of manipulating various electromagnetic properties of PBG structures inside these materials have motivated the investigator to study the some other aspects of these novel structures. This has intrigued the investigator to think if simple one-dimensional periodic multi-layered structures have other properties which can be exploited for the design of novel devices. This thesis is the result of the long years of hard work undertaken by the researcher.
Chapter 1 is the devoted to the general background related to the recent developments in the field of photonics. Various works in this field reported by many researchers have been reviewed and theoretical techniques employed by various investigators are discussed briefly. And possibilities of further work that may have profound impact in the field of photonics have been indicated in this chapter.

In chapter 2, the author considered such structures for the design of optical filter and a monochromator in ultraviolet region of the electromagnetic spectrum by using the dielectric-semiconductor multilayer system.

In chapter 3, the author has studied the optical properties such as the dispersion relation, reflectivity, group velocity and effective group index of dielectric-plasma PBG material by using Transfer Matrix method.

Chapter 4 is concerned with the realization of negative refraction without negative material in 1-D dielectric-semiconductor PBG and enhancement of the omnidirectional band gap in the same structure.

In chapter 5, the author has studied the enlargement of omnidirectional reflection in photonic crystal quantum well structures and gradual stacked PBG. In chapter 6, summary of the findings of the work reported in the form of chapter 2 to chapter 5 and scope for the future work have been mentioned.
Although the author wanted to support his theoretical investigation by experimental findings, but due to the lack of experimental facilities, it could not be materialized. While the investigator was engaged in making the complicated and tedious theoretical analysis and numerical computation, his enthusiasm was sustained by the hope that the investigation would yield significant, verifiable and technically useful information. The author will realize much reward for his endeavor, if this work is regarded as a small contribution in this very advanced and useful field of research.

(VI P I N KUMAR)
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7. **Vipin Kumar**, Kh. S. Singh, S. P. Ojha, “Negative refraction in one dimensional photonic crystal without negative refractive index
material” – International journal of microwave and optical technology.

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