Chapter 7
Design and Investigation of Line-Defected Photonic Crystal Antenna for Outstanding Data Transmission

Sathish Kumar Danasegaran
Sri Eshwar College of Engineering, India

Elizabeth Caroline Britto
IFET College of Engineering, India

S. Dhanasekaran
Sri Eshwar College of Engineering, India

G. Rajalakshmi
Sathyabama Institute of Science and Technology, India

S. Lalithakumari
Sathyabama Institute of Science and Technology, India

A. Sivasangari
Sathyabama Institute of Science and Technology, India

G. Sathish Kumar
Sri Eshwar College of Engineering, India

ABSTRACT

Wireless technology now employs 5G (generation) communication, while 6G is the subject of increased research. Various G's have evolved due to the need to achieve high data transfer for reliable communication. A tremendous data transfer rate expressed in terabits per second (Tbps) is facilitated by the terahertz (THz) spectrum. The photonic crystal (PhC) patch antenna has been proposed in this chapter, and the consequences of a line defect were examined. The defect has been embedded in the perpendicular and parallel directions of the antenna substrates. The antenna's

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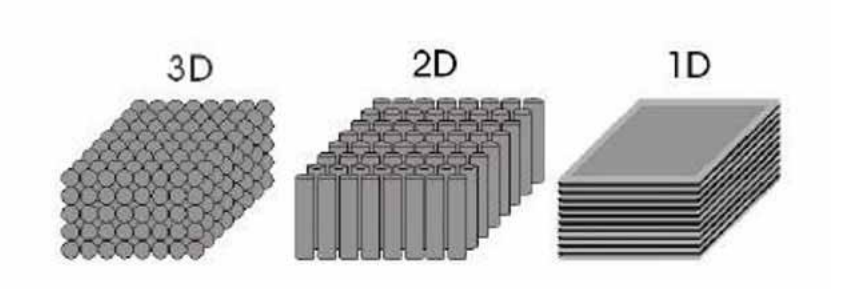
performance regarding return loss (RL), directivity, and voltage standing wave ratio (VSWR) is evaluated. The structure is simulated using CST, and the PhC structure results show excellent characteristics such as -48.02 dB RL, 1.007 VSWR, and 5.23 dB directivity at THz frequency.

I. INTRODUCTION

A PhC's (Danasegaran et al., 2024; Povinelli et al., 2021) dielectric constant varies periodically in any direction. When the PhCs dielectric constant varies in just a single direction, it is referred to as one-dimensional (1D) PhC. Two-dimensional (2D) PhC structures are those in which the material arrangement is periodic in two directions. The identical is exact for (3D) PhC, whose dielectric constant values contrast in 3D and the categorization of various PhC is shown in figure 1.

Figure 1. Types of PhC



2D PhC is the most commonly used in antenna design. The 2D PhC is available in two topologies: hole form and rod form. The hole form PhC is composed primarily of semiconductor material by a filling aspect greater than 50%. It has a structure of less indexed air-filled holes set on a back of highly indexed material. The highly indexed rods in rod type PhC are enclosed by less index surface material, and the filling factor is < 50%. Figures 2 (a) and (b) show the rod and hole category PhC structures.