FDTD SIMULATION OF A RESISTIVELY LOADED BOW-TIE ANTENNA FOR DETECTION OF BURIED METAL OBJECTS

D.N.UDUWAWALA[*,**], PETER FUKS[*], M. NORGREN[*] AND A. U. A. W. GUNAWARDENA[**]

[*] *Royal Institute of Technology, Stockholm, Sweden*
[**] *Department of Electrical and Electronic Engineering, Faculty of Engineering, University of Peradeniya*

Design of an antenna to a subsurface radar system is a critical issue. The antenna transmits signals from air to ground which is a lossy inhomogeneous dielectric medium. The antenna should have broadband characteristics in order to transmit and receive signals without distortion which is essential to distinguish the scattered signal coming from the object from other signals. Resistively loaded cylindrical and Vee dipoles, resistively or resistor loaded bow-tie antennas, spiral and horn antennas are the commonly used types. Broadband characteristics can be obtained in dipoles and bow-ties by reducing reflections of the input signal at the free ends of the antenna. This can be achieved by loading the antenna resistively.

The design of a pulse driven resistively loaded bow-tie antenna for buried metal object detection, and its radiation characteristics are discussed in this paper. A three dimensional (3-D) finite difference time domain (FDTD) scheme is employed to simulate the ground penetrating radar antenna. The ground is modeled as a homogeneous and lossless dielectric media. Two separate identical antennas are used for both transmission and reception. A Gaussian pulse is used as the input pulse signal to the transmitting antenna to operate in the 100 MHz - 500 MHz region. In order to reduce direct coupling, each antenna is enclosed in a rectangular metal cavity. When a perfectly electrical conducting sheet is buried about 1m deep in the ground, the received signal is calculated using the FDTD simulation and the ability to contrast the scattered signal from ground reflections and direct coupling is investigated.