

Abstract

The Finite Difference Time-Domain(FDTD) method, often used as a calculating method of simulating electromagnetic radiations or scattering problems. The model foundation is Maxwell's equation which is the most basic equation in electric-dynamic . It is also capable of simulating the effect of various structures in the real environment, surrounded with the absorbing boundary condition like PML(Perfectly Matched Layer), so that we can simulate the effect of electromagnetic wave in a limited space accurately.

In our developed program, we mainly use plane wave normally incident into a free space structure and plane wave oblique incident into a half space structure. But in reality, every medium are all lossy that means these medium consists of metal substance .So the purpose of using the analytical field propagation technique to implement arbitrary plane wave as incidence source condition for the lossy half space in the program that we developed is when the reflection coefficient and transmission coefficient are not suitable to use in the case of lossy substance that the method we adopt.

The plane wave reflective direction are all the same in different frequency for the reflective wave, so the electric field and the magnetic field at different point can be obtain by interpolation method but as for transmission wave we can't use the same method, because it has different transmitted angle in different frequency. The method we use is the analytical field propagation technique to implement arbitrary plane wave as incidence source condition for the lossy half space, except for multiply frequency domain differential Gauss pulse to frequency domain transmission coefficient yet need to multiply frequency domain phase constant item and frequency domain incident plane wave delay time from free space until it contact the medium layer and the frequency domain attenuation constant item. After that do the Inverse Fast Fourier Transform (iFFT) to time domain. At last we wanted to accelerate the simulation speed so we use DFT spectrum accumulation to half method, it's simulation result are all fit well with iFFT method and also fit with it's physics phenomenon.

Keywords : FDTD, plane wave, half space, analytical field propagation technique .