Chapter 5: Time-domain modeling of antennas

Introduction

Numerical modeling of antennas in the frequency domain is effective if the antenna parameters are desirable in the narrow band of frequencies. If the wideband analysis is desirable, it is better to use time-domain analysis. However, this one is suitable only for the structures with low Q-factor, otherwise, the computed response is too long, and the analysis is time consuming.

For modeling in the time domain, an analyzed structure is excited by a desired pulse **[37]**, and a transient response is computed. From the excitation pulse and the computed response, we can obtain properties of the analyzed structure at those frequencies which the excitation pulse contains. It is wideband modeling which can be used for the wideband analysis of antennas, scatterers, or in the area of the electromagnetic compatibility (EMC), or electromagnetic interference (EMI).

The time-domain modeling has several advantages in the comparison to the frequency-domain one:

- The wideband response is obtained by one run of an analysis.
- The frequency-domain analysis can not be used for the time variant or nonlinear systems.
- By the time domain-analysis, only the beginning of the transient responses can be computed, and the rest of the responses can be ignored.

Due to the above advantages of the time domain modeling, the basic principles of the time-domain modeling will be described in this chapter. Again, as in the frequency domain, the formulations which come out from Maxwell's equations in the differential or integral form are solved.