Transient Response from a Periodic Dipole Array over Layered Media

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Periodic radiating or scattering structures over layered media play an important role in such applications as integrated circuits and optical dielectrics, and their performances have been investigated extensively, both in frequency domain and in time domain. In frequency domain, the radiated electromagnetic field within any layer can be easily obtained by utilizing transmission-line analogy. However, it's difficult to obtain the transient response by invoking such techniques as Fourier transform and Cargniad-de Hoop method. This is largely due to the fact that these methods depend heavily on frequency domain solution and inverting frequency domain expressions results in modes that may be anticausal. This paper applies the analytic signal transform to this problem and a purely time domain analysis approach is accordingly formulated. After a brief introduction to the analytic signal transformation and the transient Weyl's identity, the transient analytic Green's function for the periodic dipole array is represented as an infinite sum of analytic Floquet modes, and each mode can be expressed as an integral with infinite limits. Then the integral is truncated into a finite integral by invoking the Causality Trick (M.Tygel and P. Hubral, *Transient Waves in Layered Media*, 61-69, 1987), which introduces a ghost signal into the formulation and still maintains an equivalent solution for $t > 0$. Details of this derivation as well as an asymptotic evaluation of the integral will be presented in the conference.