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# Analysis of different terminated inhomogeneous planar layered chiral media

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In this paper, an analytic frequency domain method based on Taylor's series expansion is investigated to analyze different terminated homogeneous and inhomogeneous planar layered chiral media. The validity of the presented method is verified considering some special types of chiral media, and then the application of inhomogeneous planar layered chiral media for reducing reflection from a PEC surface is concisely investigated.



## 1. Introduction

There has been increasing interest in studying interaction of electromagnetic fields with chiral media over the years. In addition to pioneering studies, recently, there is rapid development on the study of electromagnetic wave propagation in chiral media [1–6]. More recently, chiral metamaterials with many applications have attracted increasing attention [7–16]. The time-harmonic constitutive relations of an isotropic and homogeneous chiral medium assuming $e^{j\omega t}$ as time dependence are given by [7]:

$$\mathbf{D} = \varepsilon_r\varepsilon_0\mathbf{E} - j\kappa\sqrt{\varepsilon_0\mu_0}\mathbf{H}, \quad \mathbf{B} = j\kappa\sqrt{\varepsilon_0\mu_0}\mathbf{E} + \mu_r\mu_0\,\mathbf{H} \tag{1}$$

where $\varepsilon_r$ and $\mu_r$ are the relative permittivity and permeability of the chiral medium, respectively, and $\kappa$ is the chirality parameter. Chiral media have two important properties: the first one is optical activity, which can rotate the polarization plane of a linearly polarized wave propagating through it, and the second property is circular dichroism. The wave equation in a homogeneous chiral medium is:

$$\nabla^2\mathbf{E} + 2\frac{\kappa\omega}{c_0}\nabla\times\mathbf{E} + \frac{\omega^2}{c_0^2}\left(\mu_r\varepsilon_r - \kappa^2\right)\mathbf{E} = 0 \tag{2}$$

where $c_0$ and $\omega$ are the speed of light in vacuum and the angular frequency, respectively. The right and left circularly polarized waves (RCP and LCP) are the eigenpolarization of the wave equation in a homogeneous chiral medium. The propagation wavevectors of $k_+$ and $k_-$ can be introduced for the right and the LCP waves as follows [7]:

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