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INHOMOGENEOUS PLANAR LAYERED CHIRAL MEDIA: ANALYSIS OF WAVE PROPAGATION AND SCATTERING USING TAYLOR'S SERIES EXPANSION

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Abstract—In this paper, an analytic frequency domain method based on Taylor's series expansion approach is introduced to analyze inhomogeneous planar layered chiral media for an arbitrary linear combination of TM and TE polarizations. In the presented method, electromagnetic parameters of inhomogeneous chiral media and also the electric and magnetic fields are expressed using Taylor's series expansion. Finally, the validity of the method is verified considering some special types of homogeneous and inhomogeneous chiral media and comparison of the obtained results from the presented method with the exact solutions.

1. INTRODUCTION

The interaction of electromagnetic fields with chiral media has attracted many scientists and engineers over the years. The term chiral media was first used by Jaggard et al. in 1979 [1], who defined chiral media as consisting of macroscopic chiral objects randomly embedded in a dielectric. The word chiral describes something that is handed, i.e., an object whose mirror image cannot be produced solely by rotating and translating the original object. In addition to pioneering studies, recently, there is rapid development on the study of electromagnetic wave propagation in chiral media, such as chiral plate [2], chiral slab [3], electromagnetic scattering with chiral objects [4–15], and coating with chiral material for reducing radar cross-section of targets [16–20]. More recently, chiral nihility as a special case of chiral media with many applications has attracted increasing attention [21–32].

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