RECONSTRUCTING CONSTITUTIVE PARAMETERS OF INHOMOGENEOUS PLANAR LAYERED CHIRAL MEDIA BASED ON THE OPTIMIZATION APPROACH

Davoud Zarifi, Ali Farahbakhsh*, Ali Abdolali, and Mohammad Soleimani

Antenna and Microwave Research Laboratory, Department of Electrical Engineering, Iran University of Science and Technology, Tehran 1684613114, Iran

Abstract—This paper presents a frequency domain technique for reconstructing the constitutive parameters of inhomogeneous planar layered chiral media based on an optimization approach. The measured co- and cross-reflection and transmission coefficients are used to extract profiles of electromagnetic parameters of the inhomogeneous chiral media. To identify the functions of constitutive parameters of the chiral media, Fourier series expansions and Genetic Algorithm (GA) are utilized. Since the optimization problem is highly non-linear, enhanced GA in which a fuzzy system is used for improving the speed and accuracy of GA. The performance and feasibility of the proposed reconstruction method is proven using two typical examples.

1. INTRODUCTION

Unlike ordinary materials, which are described by electric permittivity and magnetic permeability, chiral media include a magneto electric coupling yielding to interesting properties of the electromagnetic fields. An object is called chiral if it cannot be superimposed on its mirror image by translations and rotations. Interaction of electromagnetic fields with chiral media has been the subject of many studies over the past decade and has led to the introduction of its wide application in different microwave devices [1–12] such as twist polarizer, polarization transformer, microwave radar absorbers, negative refraction, etc. Assuming a time harmonic field with $e^{-j\omega t}$, the constitutive relations

Received 17 December 2012, Accepted 30 January 2013, Scheduled 31 January 2013

* Corresponding author: Ali Farahbakhsh (a_farahbakhsh@iust.ac.ir).