Thin wire scatterers analysis by using a numerical method

Saeed Hatamzadeh [*,1], Zahra Masouri [2]

[1]*Department of Electrical Engineering, Islamshahr Branch, Islamic Azad University (IAU), Tehran, Iran*
[2]*Department of Mathematics, Islamshahr Branch, Islamic Azad University (IAU), Tehran, Iran*

Abstract

The focus of this article is on investigating the electromagnetic scattering behavior of thin wire structures through the application of a numerical method, specifically the Method of Moments (MoM). Thin wire scatterers, often encountered in antenna elements, support structures, and radar targets, exhibit unique current distribution and radiation characteristics that differ significantly from bulk conductors.

Keywords: Thin wire; Scatterer; Numerical method.

1. Introduction

Thin wire structures play a fundamental role in electromagnetic systems, especially in the design of antennas, reflectors, support frames, and stealth technologies. Due to their minimal cross-sectional area relative to the wavelength, thin wires present unique scattering behaviors that must be accurately characterized to ensure optimal electromagnetic performance. Understanding the interaction between incident fields and thin wire scatterers is crucial in areas such as radar signature analysis and wireless communications.

2. Numerical method to analyze thin wire scatterers

The slender geometry of such scatterers leads to complex current distributions that are not easily captured by closed-form analytical models, especially when the wires are arbitrarily shaped or located in complex environments. As a result, numerical techniques have become indispensable in the analysis of such structures. Among these, the Method of Moments (MoM) has emerged as one of the most effective approaches for modeling thin wires. By solving the Electric Field Integral Equation, MoM allows for precise calculation of induced currents and scattered fields.

[*]Corresponding author
E-mail addresses: saeed@hatamzadeh.ir (S. Hatamzadeh); nmasouri@yahoo.com (Z. Masouri)

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