

Survey of resistive bodies using current distribution

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 survey of current distribution on resistive bodies is crucial in understanding their electromagnetic response across various applications, including electromagnetic shielding, sensor design, and power electronics. This paper presents a comprehensive survey of resistive bodies by analyzing their current distribution under different excitation conditions. The study also highlights the effectiveness of different modeling techniques in accurately predicting current behavior.

Keywords: Resistive bodies; Survey; Current distribution.

1. Introduction

The survey of current distribution in resistive bodies is essential for understanding their electrical and electromagnetic behavior across numerous engineering applications. In practical scenarios, resistive materials are widely used in circuit elements, power dissipation systems, and electromagnetic shielding structures. The ability to predict and control the current flow in such materials is critical for ensuring optimal performance and mitigating undesired effects such as excessive heating, signal distortion, and electromagnetic interference (EMI).

2. Survey of resistive bodies by current

Current distribution in a resistive body is primarily governed by Maxwell's equations and Ohm's law, which relate the electric field, conductivity, and resulting current density. Unlike perfectly conducting surfaces, where currents are predominantly confined to the outermost layers (due to the skin effect at high frequencies), resistive bodies exhibit a more diffused current distribution that depends on material resistivity, geometry, and the nature of external excitations.

*Corresponding author

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

References

- [1] S. Hatamzadeh-Varmazyar, M. Naser-Moghadasi, An integral equation modeling of electromagnetic scattering from the surfaces of arbitrary resistance distribution, *Progress In Electromagnetics Research B* 3, 157-172, 2008.
- [2] S. Hatamzadeh-Varmazyar, M. Naser-Moghadasi, Z. Masouri, A moment method simulation of electromagnetic scattering from conducting bodies, *Progress In Electromagnetics Research* 81, 99-119, 2008.
- [3] S. Hatamzadeh-Varmazyar, M. Fathy, Z. Masouri, Optimization of face recognition algorithms using wavelet transforms, 40th Annual Iranian Mathematics Conference, Sharif University of Technology, Tehran, Iran, 2009.
- [4] E. Babolian, Z. Masouri, S. Hatamzadeh-Varmazyar, Introducing a direct method to solve nonlinear Volterra and Fredholm integral equations using orthogonal triangular functions, *Mathematics Scientific Journal* 5 (1), 11-26, 2009.
- [5] S. Hatamzadeh-Varmazyar, Z. Masouri, Numerical expansion-iterative method for analysis of integral equation models arising in one-and two-dimensional electromagnetic scattering, *Engineering Analysis with Boundary Elements* 36 (3), 416-422, 2012.
- [6] S. Hatamzadeh-Varmazyar, Z. Masouri, A numerical method for calculation of electrostatic charge distribution induced on conducting surfaces, *Advanced Computational Techniques in Electromagnetics* 2014, 1-9, 2014.
- [7] Z. Masouri, S. Hatamzadeh-Varmazyar, Applying integral equation modeling technique in determination of charge distribution on conducting structures, *Advanced Computational Techniques in Electromagnetics* 2013, 1-8, 2013.
- [8] E. Babolian, Z. Masouri, S. Hatamzadeh-Varmazyar, Numerical solution of nonlinear Volterra-Fredholm integro-differential equations via direct method using triangular functions, *Computers & Mathematics with Applications* 58 (2), 239-247, 2009.
- [9] E. Babolian, Z. Masouri, S. Hatamzadeh-Varmazyar, A direct method for numerically solving integral equations system using orthogonal triangular functions, *International Journal of Industrial Mathematics* 1 (2), 135-145, 2009.
- [10] S. Hatamzadeh-Varmazyar, M. Naser-Moghadasi, New numerical method for determining the scattered electromagnetic fields from thin wires, *Progress In Electromagnetics Research B* 3, 207-218, 2008.
- [11] E. Babolian, Z. Masouri, S. Hatamzadeh-Varmazyar, New direct method to solve nonlinear Volterra-Fredholm integral and integro-differential equations using operational matrix with block-pulse functions, *Progress In Electromagnetics Research B* 8, 59-76, 2008.

- [12] S. Hatamzadeh-Varmazyar, Z. Masouri, Determining the electromagnetic fields scattered from PEC cylinders, *International Journal of Mathematics & Computation* 28 (4), 1-8, 2017.
- [13] R. Danesfahani, S. Hatamzadeh-Varmazyar, E. Babolian, Z. Masouri, Applying shannon wavelet basis functions to the method of moments for evaluating the radar cross section of the conducting and resistive surfaces, *Progress In Electromagnetics Research B* 8, 257-292, 2008.
- [14] S. Hatamzadeh-Varmazyar, Z. Masouri, Numerical method for analysis of one-and two-dimensional electromagnetic scattering based on using linear Fredholm integral equation models, *Mathematical and Computer Modelling* 54 (9), 2199-2210, 2011.
- [15] Z. Masouri, E. Babolian, S. Hatamzadeh-Varmazyar, An expansion-iterative method for numerically solving Volterra integral equation of the first kind, *Computers & Mathematics with Applications* 59 (4), 1491-1499, 2010.
- [16] S. Hatamzadeh-Varmazyar, Z. Masouri, A numerical approach for calculating the radar cross-section of two-dimensional perfect electrically conducting structures, *Journal of Electromagnetic Waves and Applications* 28 (11), 1360-1375, 2014.
- [17] S. Hatamzadeh-Varmazyar, M. Naser-Moghadasi, E. Babolian, Z. Masouri, Numerical approach to survey the problem of electromagnetic scattering from resistive strips based on using a set of orthogonal basis functions, *Progress In Electromagnetics Research* 81, 393-412, 2008.
- [18] S. Hatamzadeh-Varmazyar, Z. Masouri, E. Babolian, Numerical method for solving arbitrary linear differential equations using a set of orthogonal basis functions and operational matrix, *Applied Mathematical Modelling* 40 (1), 233-253, 2016.
- [19] S. Hatamzadeh-Varmazyar, Z. Masouri, A computational method for numerically solving linear integro-differential equations, *International Journal of Mathematics & Computation* 29 (1), 82-93, 2018.
- [20] S. Hatamzadeh-Varmazyar, M. Naser-Moghadasi, E. Babolian, Z. Masouri, Calculating the radar cross section of the resistive targets using the Haar wavelets, *Progress In Electromagnetics Research* 83, 55-80, 2008.
- [21] Z. Masouri, S. Hatamzadeh-Varmazyar, An analysis of electromagnetic scattering from finite-width strips, *International Journal of Industrial Mathematics* 5 (3), 199-204, 2013.
- [22] Z. Masouri, E. Babolian, S. Hatamzadeh-Varmazyar, Collocation method for solving Fredholm integral equation of the first kind using Shannon wavelet system, 41th Annual Iranian Mathematics Conference, Urmia University, Urmia, Iran, 316, 2010.

- [23] S. Hatamzadeh-Varmazyar, M. Naser-Moghadasi, R. Sadeghzadeh-Sheikhan, One-and two-dimensional scattering analysis using a fast numerical method, *IET Microwaves, Antennas & Propagation* 5 (10), 1148-1155, 2011.
- [24] R. Danesfahani, S. Hatamzadeh-Varmazyar, E. Babolian, Z. Masouri, A scheme for RCS determination using wavelet basis, *AEU-International Journal of Electronics and Communications* 64 (8), 757-765, 2010.
- [25] S. Hatamzadeh-Varmazyar, Z. Masouri, A fast numerical method for analysis of one-and two-dimensional electromagnetic scattering using a set of cardinal functions, *Engineering Analysis with Boundary Elements* 36 (11), 1631-1639, 2012.
- [26] E. Babolian, Z. Masouri, S. Hatamzadeh-Varmazyar, A set of multi-dimensional orthogonal basis functions and its application to solve integral equations, *International Journal of Applied Mathematics and Computation* 2 (1), 032-049, 2010.
- [27] S. Hatamzadeh-Varmazyar, M. Naser Moghadasi, R. Sadeghzadeh-Sheikhan, Numerical method for analysis of radiation from thin wire dipole antenna, *International Journal of Industrial Mathematics* 3 (2), 135-142, 2011.
- [28] S. Hatamzadeh-Varmazyar, The error analysis and convergence evaluation of a computational technique for solving electromagnetic scattering problems, *Advanced Computational Techniques in Electromagnetics* 2015 (1), 66-69, 2015.
- [29] Z. Masouri, S. Hatamzadeh-Varmazyar, Numerical solution of Fredholm integral equations of the first kind with real or complex kernel using triangular functions, *38th Annual Iranian Mathematics Conference, Zanjan University, Zanjan, Iran*, 284-286, 2007.
- [30] S. Hatamzadeh-Varmazyar, Z. Masouri, Calculation of electric charge density based on a numerical approximation method using triangular functions, *Advanced Computational Techniques in Electromagnetics* 2013, 1-11, 2013.
- [31] Z. Masouri, S. Hatamzadeh-Varmazyar, E. Babolian, Numerical method for solving system of Fredholm integral equations using Chebyshev cardinal functions, *Advanced Computational Techniques in Electromagnetics* 2014, 1-13, 2014.
- [32] Z. Masouri, S. Hatamzadeh-Varmazyar, Evaluation of current distribution induced on perfect electrically conducting scatterers, *International Journal of Industrial Mathematics* 5 (2), 167-173, 2013.
- [33] S. Hatamzadeh-Varmazyar, Z. Masouri, An Efficient Numerical Algorithm For Solving Linear Differential Equations of Arbitrary Order And Coefficients, *International Journal of Industrial Mathematics* 10 (2), 127-138, 2018.

- [34] S. Hatamzadeh-Varmazyar, Z. Masouri, A fast and accurate expansion-iterative method for solving second kind Volterra integral equations, *International Journal of Industrial Mathematics* 10 (1), 29-37, 2018.
- [35] S. Hatamzadeh-Varmazyar, Z. Masouri, A numerical scheme for two-dimensional scattering analysis, *International Journal of Mathematics & Computation* 29 (2), 84-94, 2018.
- [36] S. Hatamzadeh-Varmazyar, Z. Masouri, Numerical Solution of Second Kind Volterra and Fredholm Integral Equations Based on a Direct Method Via Triangular Functions, *International Journal of Industrial Mathematics* 11 (2), 79-87, 2019.
- [37] Z. Masouri, S. Hatamzadeh, A Regularization-direct Method to Numerically Solve First Kind Fredholm Integral Equation, *Kyungpook Mathematical Journal* 60 (4), 869-881, 2020.
- [38] S. Hatamzadeh, Z. Masouri, A numerical evaluation of radiation from dipole antenna based on a set of wavelet functions, *International Journal of Imaging and Robotics* 21 (1), 45-56, 2021.
- [39] S. Hatamzadeh, Z. Masouri, Applying a set of orthogonal basis functions in numerical solution of Hallen's integral equation for dipole antenna of perfectly conducting material, *Journal of Modern Materials* 9 (1), 36-49, 2022.
- [40] Z. Masouri, S. Hatamzadeh, A Computational Approach for Analysis of Scattering Characteristics for Strips of Resistive Material, *International Journal of Research Publication and Reviews* 4 (12), 3640-3646, 2023.
- [41] Z. Masouri, S. Hatamzadeh, An Efficient Scheme for Optimization of Recognition Algorithms, *International Journal of Research Publication and Reviews* 5 (2), 1746-1749, 2024.
- [42] S. Hatamzadeh, Z. Masouri, A data analysis based survey on a scheme for solving integral equations, *International Conference on Optimization and Data Science in Industrial Engineering (ODSIE 2024)*, Istanbul, Turkey, Nov. 7-8, 2024.