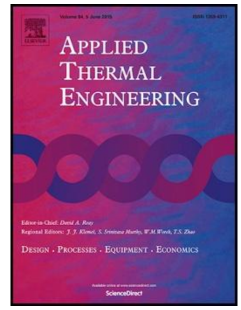

Title: A space-fractional model of thermo-electromagnetic wave propagation in anisotropic media

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PII: S1359-4311(15)01051-0
DOI: http://dx.doi.org/doi:10.1016/j.applthermaleng.2015.09.119
Reference: ATE 7121

To appear in: *Applied Thermal Engineering*

Received date: 24-6-2015
Accepted date: 29-9-2015

Please cite this article as: F.A. Godínez, O. Chávez, A. García, R. Zenit, A space-fractional model of thermo-electromagnetic wave propagation in anisotropic media, *Applied Thermal Engineering* (2015), http://dx.doi.org/doi:10.1016/j.applthermaleng.2015.09.119.

A space-fractional model of thermo-electromagnetic wave propagation in anisotropic media
By Godinez et al. (Paper ATE-2015-9334)
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Highlights

- A conjugate theoretical model was developed to study the heat propagation in a fractal media.
- The model couples electromagnetic and thermal conservation equations in fractal space.
- Solutions of the model are obtained numerically, in dimensionless terms.
- A maximum heat transfer rate is observed at an intermediate fractal dimension.

Abstract
A theoretical study of the propagation of electromagnetic waves through anisotropic media is presented. An Euclidean nonlinear model that couples Maxwell's and heat transfer equations is generalized considering Stillinger's formalism in terms of a spatial fractal dimension α. The numerical results reveal a significant influence of α on current density and temperature distributions along the radial direction of a cylindrical conductor. When α increases approaching unity, the anisotropy of the medium becomes increasingly weak; thus the wave penetrates deeper into the medium and the skin effect is weakened. Interestingly, the steady state temperature at any location along the radial direction reaches a maximum at $\alpha = 1/2$. Beyond this maximum, the temperature decreases with increasing α, reaching a finite value at the Euclidean limit $\alpha = 1$. The generalized model presented here not only simplifies the analysis of electromagnetic transmission through complex structures such as porous media but also provides a quantitative measure of the anisotropy along the radial direction of the conductive medium by a fractional dimension.

Keywords: thermo-electromagnetic, complex porous media, fractional model

1. Introduction

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