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Generalized Yang-Fourier Transforms by using M-Series to Heat-Conduction in a Semi-Infinite Fractal Bar

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Abstract: The purpose of present paper to solve 1-D fractal heat-conduction problem in a fractal semi-infinite bar has been developed by local fractional calculus employing the analytical Generalized Yang-Fourier transforms method.
Keywords and phrases: Fractal bar, heat-conduction equation, A Generalized Yang-Fourier transforms, Yang-Fourier transforms, local fractional calculus, M-Series.

1. Introduction

Generalized Yang-Fourier transforms which is obtained by author by generalization of Yang-Fourier transforms (using M-series) is a technique of fractional calculus for solving mathematical, physical and engineering problems. The fractional calculus is continuously growing in last five decades [1-7]. Most of the fractional ordinary differential equations have exact analytic solutions, while others required either analytical approximations or numerical techniques to be applied, among them: fractional Fourier and Laplace transforms [8,41], heat-balance integral method [9-11], variation iteration method (VIM) [12-14], decomposition method [15,41], homotopy perturbation method [16,41] etc.

The problems in fractal media can be successfully solved by local fractional calculus theory with problems for non-differential functions [25-32]. Local fractional differential equations have been applied to model complex systems of fractal physical phenomena [30-41] local fractional Fourier series method [38], Yang-Fourier transform [39, 40,41].

1.1 The M-Series

The M-series is a particular case of the H- function. A special role is in the application of fractional calculus operators and in the solutions of fractional order differential equations.
The M-series:

$$_pM_q^{\alpha}(a_1...a_p; b_1...b_q; z) = \sum_{k=0}^{\infty} \frac{(a_1)_n...(a_p)_n}{(b_1)_n...(b_q)_n} \frac{z^k}{\Gamma(\alpha n+1)} \qquad (1a)$$