

Functional Analysis and Applications Group

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Research topics:

Boundary Value Problems and Differential Equations

Functional Analysis and Operator Theory

Integral Equations and Transforms

Applications to other Fields

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For more information about the Functional Analysis and Applications Group, including a complete list of publications for the period 2013-2017, please explore the website



<http://cidma.mat.ua.pt/ma/group.php?grupo=3>



RESEARCH PAPER

FUNDAMENTAL SOLUTION OF THE MULTI-DIMENSIONAL TIME FRACTIONAL TELEGRAPH EQUATION

Milton Ferreira ^{1,2}, M. Manuela Rodrigues ², Nelson Vieira ³

Abstract

In this paper we study the fundamental solution (FS) of the multi-dimensional time-fractional telegraph equation where the time-fractional derivatives of orders $\alpha \in [0, 1]$ and $\beta \in [1, 2]$ are in the Caputo sense. Using the Fourier transform we obtain an integral representation of the FS in the Fourier domain expressed in terms of a multivariate Mittag-Leffler function. The Fourier inversion leads to a double Mellin-Barnes type integral representation and consequently to a H -function of two variables. An explicit series representation of the FS, depending on the parity of the dimension, is also obtained. As an application, we study a telegraph process with Brownian time. Finally, we present some moments of integer order of the FS, and some plots of the FS for some particular values of the dimension and of the fractional parameters α and β .

MSC 2010: Primary 35R11; Secondary 26A33, 35A08, 35A22, 35C15, 60G22

Key Words: time-fractional telegraph equation, fundamental solution, Caputo fractional derivative, H -function of two variables, double H -function.

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Two positive solutions of a class of Schrödinger–Poisson system with indefinite nonlinearity

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ABSTRACT

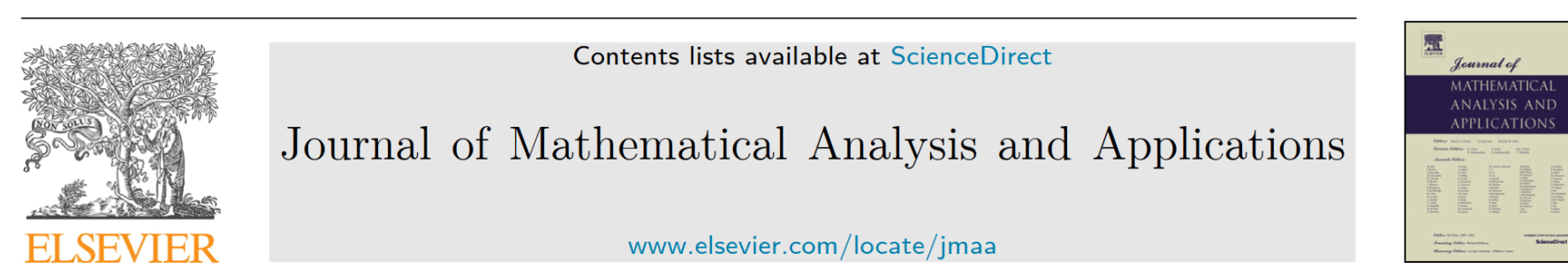
We study the existence and multiplicity of positive solutions of a class of Schrödinger–Poisson system:

$$\begin{cases} -\Delta u + u + f(x)\phi u = k(x)|u|^{p-2}u + \mu h(x)u & \text{in } \mathbb{R}^3, \\ -\Delta \phi = f(x)u^2 & \text{in } \mathbb{R}^3, \end{cases}$$

where $4 < p < 6$, $k \in C(\mathbb{R}^3)$, k changes sign in \mathbb{R}^3 and $\lim_{|x| \rightarrow \infty} k(x) = k_\infty < 0$. We mainly prove the existence of at least two positive solutions in the case that $\mu > \mu_1$ and near μ_1 , where μ_1 is the first eigenvalue of $-\Delta + id$ in $H^1(\mathbb{R}^3)$ with weight function h , whose corresponding eigenfunction is denoted by e_1 . An interesting phenomenon is that we do not need the condition $\int_{\mathbb{R}^3} k(x)e_1^2 dx < 0$, which has been shown to be a necessary condition to the existence of positive solutions for semilinear elliptic equations with indefinite nonlinearity (see e.g. S. Alama, G. Tarantello, On semilinear elliptic equations with indefinite nonlinearities, Calc. Var. Partial Differential Equations 1 (1993) 439–475).

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Wave diffraction by wedges having arbitrary aperture angle

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ABSTRACT

The problem of plane wave diffraction by a wedge sector having arbitrary aperture angle has a very long and interesting research background. In fact, we may recognize significant research on this topic for more than one century. Despite this fact, up to now no clear unified approach was implemented to treat such a problem from a rigorous mathematical way and in a consequent appropriate Sobolev space setting. In the present paper, we are considering the corresponding boundary value problems for the Helmholtz equation, with complex wave number, admitting combinations of Dirichlet and Neumann boundary conditions. The main ideas are based on a convenient combination of potential representation formulas associated with (weighted) Mellin pseudo-differential operators in appropriate Sobolev spaces, and a detailed Fredholm analysis. Thus, we prove that the problems have unique solutions (with continuous dependence on the data), which are represented by the single and double layer potentials, where the densities are solutions of derived pseudo-differential equations on the half-line.

ABSTRACT

In this article we study atomic and molecular decompositions in 2-microlocal Besov and Triebel–Lizorkin spaces with variable integrability. We show that, in most cases, the convergence implied in such decompositions holds not only in the distributions sense, but also in the function spaces themselves. As an application, we give a simple proof for the denseness of the Schwartz class in such spaces. Some other properties, like Sobolev embeddings, are also obtained via atomic representations.

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Atomic and molecular decompositions in variable exponent 2-microlocal spaces and applications [☆]

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Birkhäuser Mathematics

Operator Theory, Advances and Applications



Advances in Harmonic Analysis and Operator Theory

The Stefan Samko Anniversary Volume

Editors: Almeida, Alexandre, Castro, Luis Filipe, Speck, Frank-Olme (Eds.)

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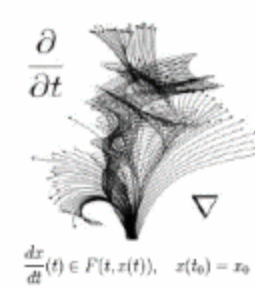
About this book

This volume is dedicated to Professor Stefan Samko on the occasion of his seventieth birthday. The contributions display the range of his scientific interests in harmonic analysis and operator theory. Particular attention is paid to fractional integrals and derivatives, singular, hypersingular and potential operators in variable exponent spaces, pseudodifferential operators in various modern function and distribution spaces, as well as related applications, to mention but a few. Most contributions were firstly presented in two conferences at Lisbon and Aveiro, Portugal, in June–July 2011.

RECENT TRENDS IN DIFFERENTIAL EQUATIONS

AN INTERNATIONAL CONFERENCE TO CELEBRATE THE 75TH BIRTHDAY OF ARRIGO CELLINA AND THE 60TH BIRTHDAY OF ALBERTO BRESSAN

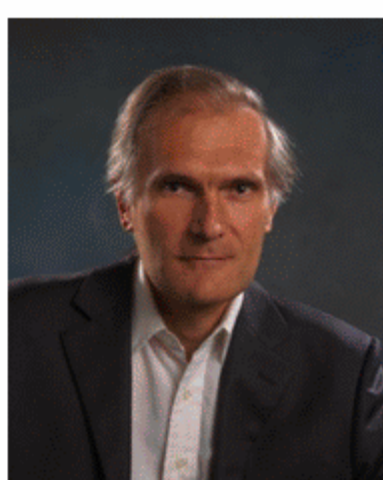
June 27-29, 2016, Aveiro, Portugal



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ABOUT THE CONFERENCE

The conference "Recent trends in Differential Equations" will celebrate the 75th birthday of Professor Arrigo Cellina and the 60th birthday of Professor Alberto Bressan and aims to bring together mathematicians engaged in research on differential equations, differential inclusions and set valued maps, calculus of variations, control theory, and applications.

IWOTA 2019

International Workshop on Operator Theory and its Applications

July 22-26, 2019
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Organising Committee

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Forthcoming conference

Libertas Mathematica (new series)

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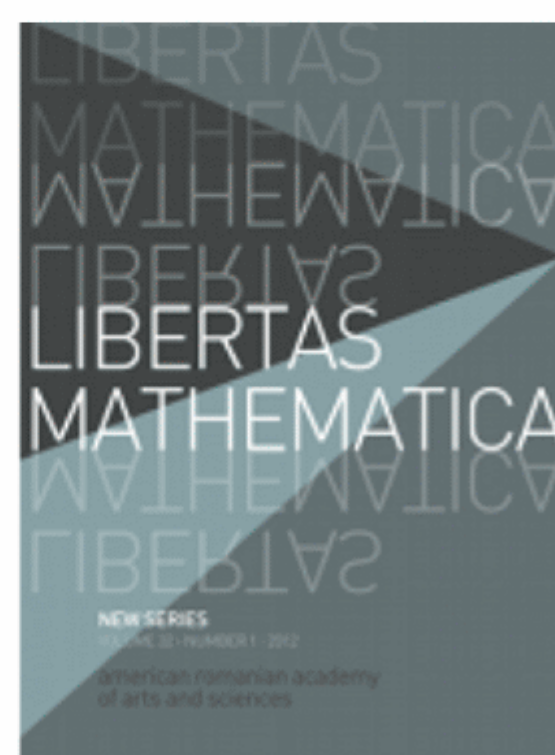
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The web page of our Seminar:

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To tackle in the future:

- Variational problems with fast growth;
- Equations with p-Laplacian-like operators and nonsmooth or multivalued terms;
- Kolmogorov–Petrovskii–Piskunov–Fisher equations;
- Differential inclusions by using measure theory;
- Boundary value problems arising from diffraction problems and composite materials;
- Besov and Triebel–Lizorkin spaces of variable exponents, and corresponding Besov–Morrey and Triebel–Lizorkin–Morrey spaces;
- Fractional calculus;
- Special functions, new integral transforms and convolutions;
- Potential and Fredholm theory for integral operators;
- SIR models and firms' efficiency in several sectors.

A book on Function Spaces is also planned to be concluded.