

Editorial

Advanced Mathematical Methods: Theory and Applications

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The many technical and computational problems that appear to be constantly emerging in various branches of physics and engineering beg for a more detailed understanding of the fundamental mathematics that serves as the cornerstone of our way of understanding natural phenomena. The purpose of this Special Issue is to establish a brief collection of carefully selected articles authored by promising young scientists and the world's leading experts in pure and applied mathematics, highlighting the state-of-the-art of the various research lines focusing on the study of analytical and numerical mathematical methods for pure and applied sciences.

Our collection opens with a featured review article [1], by Yuri Luchko, aimed at providing a pedagogical discussion of the role of integral transforms in mathematical physics, with particular regard for the Laplace and Mellin transforms. We continue with another survey paper [2], by Roberto Garrappa, Eva Kaslik, and Marina Popolizio, dedicated to an in-depth analysis evaluation of fractional integrals and derivatives of some elementary functions. Similarly to the first article, the work of R. Garrappa et al. is very pedagogical in nature and can serve as an effective reference to those who wish to gradually approach the study of numerical aspects of fractional calculus.

This collection then continues with two important featured articles. Specifically, it starts with the work [3], by Emilia Bazhlekova and Ivan Bazhlekov, concerning a subordination approach to the multi-dimensional space–time fractional diffusion equation. In detail, the fundamental solution of this equation is studied by means of the subordination principle, which in turn provides a relation to the classical Gaussian function. We then move to the contribution [4], by Silvia Vitali, Iva Budimär, Claudio Runfola, and Gastone Castellani, dedicated to the study of the role of the central limit theorem within the framework of an heterogeneous ensemble of Brownian particles (dubbed the HEBP approach, for short).

The collection then closes with a series of eight very interesting original contributions. We begin this series with the work of Marina Popolizio [5] analyzing numerical properties and theoretical features of the Mittag–Leffler function with matrix arguments. It is then followed by an interesting note [6] on a generalization of the time-fractional relativistic diffusion equation based on the application of Caputo fractional derivatives of a function with respect to another function, by Luisa Beghin and Roberto Garra. We then move to biophysical modeling with the inspiring work [7] by Berardino D'Acunto, Luigi Frunzo, Vincenzo Luongo, and Maria Rosaria Mattei, in which the authors propose a mathematical model of heavy metal sorption and interaction in a multispecies biofilm. We then continue with a pedagogical article on space–time exterior calculus [8], and its relation to Maxwell's theory, by Ivano Colombaro, Josep Font-Segura, and Alfonso Martinez. One then finds an interesting proposal for a mathematical model of economic growth with fading memory and a continuous distribution of time-delay. This work [9], by Vasily E. Tarasov, and Valentina V. Tarasova, represents a generalization of the standard Keynesian macroeconomic model based on Abel-type integrals and integro-differential operators involving the confluent hypergeometric Kummer function in the kernel.

Advanced Mathematical Methods

Katrin Zwirgmaier



Advanced Mathematical Methods:

Reviewing **Advanced Mathematical Methods**: Unlocking the Spellbinding Force of Linguistics

In a fast-paced world fueled by information and interconnectivity, the spellbinding force of linguistics has acquired newfound prominence. Its capacity to evoke emotions, stimulate contemplation, and stimulate metamorphosis is truly astonishing. Within the pages of "**Advanced Mathematical Methods**," an enthralling opus penned by a very acclaimed wordsmith, readers attempt an immersive expedition to unravel the intricate significance of language and its indelible imprint on our lives. Throughout this assessment, we shall delve into the book's central motifs, appraise its distinctive narrative style, and gauge its overarching influence on the minds of its readers.

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Table of Contents Advanced Mathematical Methods

1. Understanding the eBook Advanced Mathematical Methods
 - The Rise of Digital Reading Advanced Mathematical Methods
 - Advantages of eBooks Over Traditional Books
2. Identifying Advanced Mathematical Methods
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Advanced Mathematical Methods
 - User-Friendly Interface
4. Exploring eBook Recommendations from Advanced Mathematical Methods
 - Personalized Recommendations
 - Advanced Mathematical Methods User Reviews and Ratings
 - Advanced Mathematical Methods and Bestseller Lists

5. Accessing Advanced Mathematical Methods Free and Paid eBooks
 - Advanced Mathematical Methods Public Domain eBooks
 - Advanced Mathematical Methods eBook Subscription Services
 - Advanced Mathematical Methods Budget-Friendly Options
6. Navigating Advanced Mathematical Methods eBook Formats
 - ePub, PDF, MOBI, and More
 - Advanced Mathematical Methods Compatibility with Devices
 - Advanced Mathematical Methods Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Advanced Mathematical Methods
 - Highlighting and Note-Taking Advanced Mathematical Methods
 - Interactive Elements Advanced Mathematical Methods
8. Staying Engaged with Advanced Mathematical Methods
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Advanced Mathematical Methods
9. Balancing eBooks and Physical Books Advanced Mathematical Methods
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Advanced Mathematical Methods
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine Advanced Mathematical Methods
 - Setting Reading Goals Advanced Mathematical Methods
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Advanced Mathematical Methods
 - Fact-Checking eBook Content of Advanced Mathematical Methods
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning

- Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
14. Embracing eBook Trends
- Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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