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Editorial

Preface to the Special Issue "State-of-the-Art Mathematical Applications in Europe"

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This book collects under one cover twelve original research papers and one review paper submitted to the Special Issue "State-of-the-Art Mathematical Applications in Europe" and published in the MDPI journal *Mathematics* from December 2021 to January 2023. This Special Issue welcomed original research contributions from European researchers and their collaborators in all fields of mathematics on popular topics. The Editors received papers from Spain, Slovenia, Romania, Italy, Greece, Russia, Montenegro and Turkey. Most of the contributions were related to various fields in applied mathematics, and several papers addressed problems in pure mathematics, particularly algebra. We provide a brief overview of the papers included in this Special Issue, allowing readers to become acquainted with the submissions close to their research interests.

The first four articles published in this collection present different mathematical models to solve problems arising in mathematical physics. In particular, the first two deal with the study of heat transfer in engineering devices, the third study tackles bio-magnetic fluid dynamics and the fourth one concerns solid particle dissolution. Contribution 1 proposes a numerical solution to one problem related to heat transfer performance in an electronic cabinet with a heat-generating element placed in a solid/porous finned heat sink using a code in C++ programming language. In Contribution 2, a numerical analysis of the natural convective energy transport in a differentially heated chamber with isothermal vertical walls and a porous fin system has been performed. This study reveals the importance of the porous fins for energy removal from heated surfaces. An interesting mathematical method based on the application of two-parameter group theory is proposed in Contribution 3 for the study of blood flow with magnetic particles, combining ferrohydrodynamic and magnetohydrodynamic principles in a two-dimensional cylinder. The authors argue that this research could have applications in biomedical sciences, drug administration, cancer therapy and surgery. A new mathematical model describing transformations of chemical kinetics equations and the heterogeneous processes of solid particle dissolution is proposed in Contribution 4. Theoretical results are presented related to the process of coke calcination in a tabular rotary kiln.

Contribution 5 focuses on navigation algorithms for autonomous industrial vehicles. The authors implemented an algorithm for indoor navigation of automated guided vehicles, combining ideas from computer vision and neural networks to achieve collision-free navigation. The advantages of the proposed algorithm and its stability are discussed. The aim of Contribution 6 is to design an expectation maximization (EM) algorithm for estimating the parameters of some models by using maximum likelihood. To achieve this, two new general probability distribution families generated by the discrete Lindley distribution have been constructed. Contribution 7 develops a decision-making model

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that refers to the discrepancy between normative models and empirical evidence in the context of intertemporal choices. The experimental part illustrates the implementation of the proposed theoretical model.

Three articles in the collection are in the field of algebra. In Contribution 8, the authors describe the structure of BL-algebras, a special type of residuated lattice corresponding to Hajek's fuzzy logic, through the theory of commutative rings. These ideas form the basis of a recursive algorithm that generates all isomorphism classes of finite BL-algebras. In Contribution 9, the authors introduce the concept of weakly semi-artinian supplements (WSA supplements), investigate their properties, and apply WSA supplements for the characterization of weakly semi-artinian modules. Several homological properties of the proper class of short exact sequences determined by WSA-supplemented submodules are discussed. Contribution 10 presents new developments in hypercompositional algebra, in particular in the field of Krasner hypermodules. The authors provide equivalent characterizations of the supplemented Krasner hypermodules, connecting the supplements and the direct summands to the normal projectivity.

The behaviour of the Lagrange interpolation polynomials of the absolute value function is the topic of Contribution 11. The authors employ Chebyshev and Chebyshev–Lobatto nodal systems with an even number of points to demonstrate that the Gibbs–Wilbraham phenomena are significantly different in shape and amplitude. The last original article in this collection, Contribution 12, is in the field of nonlinear fractional differential equations. Conditions for the existence, uniqueness and stability of the solutions for a class of fractional Riemann–Liouville initial value problems are obtained. The theoretical results are supported by concrete examples.

This Special Issue concludes with Contribution 13, providing an overview of the topic of singular and degenerate partial differential equations. Most of the results recalled here were presented during the conference "Advances in Singular and Degenerate PDEs", dedicated to the research career of Prof. Maria Agostina Vivaldi. This issue discusses recent research problems on the topic and contains a very rich bibliography.

The papers in the Special Issue "State-of-the-Art Mathematical Applications in Europe" were published online after their acceptance. We are pleased to say that one year after their publication, each article in this Special Issue has been viewed more than one thousand times, which is evidence of both researchers' interest in Applied Mathematics and the importance of open access research. The Guest Editors would like to express their gratitude to all the authors for their valuable contributions to this Special Issue, as well as to the anonymous reviewers for their useful and professional comments that helped the authors substantially improve the final quality of the submitted manuscripts. We also acknowledge with pleasure the great cooperation of the publisher, the help from MDPI editors in the realization of this project, and the unfailing support from the Managing Editor of this Special Issue, Dr. Syna Mu.

Conflicts of Interest: The authors declare no conflicts of interest.

List of Contributions

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