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Editorial

Preface to the Special Issue "Mathematical Modeling with Differential Equations in Physics, Chemistry, Biology, and Economics"

Arsen Palestini

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Preface to the Special Issue "Mathematical Modeling with Differential Equations in Physics, Chemistry, Biology, and Economics"

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First of all, I would like to express my warmest thanks to all the scholars who participated by submitting their papers to this Special Issue. As the Guest Editor of this volume, I was delighted to see that the articles that have been proposed over these months are all valuable, interesting and original. My acknowledgements also go to all the reviewers for their commitment, which was extremely helpful to improve the quality of the scientific contributions.

The staff of *Mathematics* (to whom I am very grateful) and I chose to avoid excessive constraints when we conceived this Special Issue in order to keep the number of the possible contributors as high as possible; anyone with brilliant results involving differential equations was welcome. In line with this inclusive approach, we received manuscripts from many disciplines with various lines of research.

I am hopeful that all readers of the papers included in this Special Issue will find them interesting, novel and, above all, inspirational.

The contents of the volume are outlined in this brief introduction, after which I will let you enjoy the papers.

To begin with, we accepted two articles on Runge–Kutta pairs: In Kovalgonov et al. [1], a new Runge–Kutta pair of orders $(5,4)$ is constructed to address problems with periodic solutions and, in particular, the performance of the related method is excellent on a couple of oscillators. On the other hand, Shen et al. [2] consider a family of explicit Runge–Kutta pairs of orders $(6,5)$ to establish a method which performs efficiently on a wide range of orbital problems, such as perturbed Kepler with various disturbances and Arenstorf and Pleiades.

An old but relevant problem is tackled by Ritelli [3], who addressed the issue of a two parameter family of differential equations which was originally treated by Italian mathematician Jacopo Riccati in the 18th century. The closed form integration of a differential equation, more general to the one treated in Riccati's contribution, is obtained, through the use of Lie Symmetries.

A very peculiar application is provided by economists Solferino and Tessitore [4], who derived a theoretical model to shed light on the dynamics leading to toxic relationships, to outline the conditions for the best policy to heal from a toxic relationship.

A dynamic financial model is proposed by Fabretti [5], who investigates the behaviour of a stock price in a given scenario, providing some insights on equilibrium and chaos.

Boykov et al. [6] carry out a study of the stability of solutions to systems of differential equations with discontinuous right-hand sides, providing some applications to Hopfield Artificial Neural Networks.

In our Special Issue, there is also an SEIR epidemiological model by Husniah et al. [7], where the use of convalescent plasma is supposed to reduce the diffusion of a disease such as COVID-19.

Some valuable mathematical results are obtained by Ryoo and Kang [8], whose analysis focuses on q-Hermite polynomials arising from certain differential equations.

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Rahman et al. [9] propose an inventory model for mixing liquid considering preservation facility, which is solved numerically.

Finally, De Marchis et al. [10] investigate accidental degeneracy of a linear, second-order elliptic, Schrödinger-type differential operator.

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