Discrete Dynamics in Nature and Society

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Special Issue on

Discrete Dynamics of Fractional Systems: Theory and Numerical Techniques

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In recent decades, fractional calculus has found a large number of profound applications, which have triggered the development of both the theory and methods for more reliable discretization and approximations of the dynamics of continuous systems. Fractional order models and discrete problems are nonlocal. They provide better descriptions and, ultimately, a better understanding of underlying complex phenomena in sciences and technology. To that end, novel analytical methods to investigate qualitative features of the solutions of these nonlocal systems as well as more general results on the existence and the uniqueness of suitable solutions are desirable tools in the study of fractional systems.

At the same time, continuous models based on systems of ordinary or partial differential equations have been investigated via various criteria of discretization. Novel numerical methods to approximate the solutions of fractional systems have emerged in the literature. However, the search for discrete techniques which are faster and stable, which possess a higher order of convergence at lower computational costs, and which preserve the main features of the solutions of interest, is a constant pursuit in the numerical analysis. In particular, the design of discretization of continuous fractional systems that preserve important characteristics, such as positivity, boundedness, convexity, monotonicity, and energy, is a fruitful area of research that merits a closer attention.

In light of these facts, the purpose of this special issue is to publish original high-quality research papers and review articles that address the latest progress on theoretical analytical methods of discrete fractional systems or that analyze new numerical discretization of fractional differential equations arising in the sciences and technology. Rather than mere applications of standard analytical and numerical techniques, our emphasis is on novel theoretical results and the analysis of new methodologies.

Potential topics include but are not limited to the following:

- Innovative methods of theoretical analysis
- Existence and uniqueness of solutions
- Structure-preserving discretization
- Qualitative properties of fractional equations and systems
- Novel approximations of nonlocal fractional problems
- Applications of fractional systems to relevant topics in nature and society

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