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Editorial

Recent Developments and Applications on Qualitative Theory of Fractional Equations and Related Topics

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Recently, fractional differential equations have been the object of considerable interest amongst researchers. This is justified by the intensive development of the theory of fractional differential equations itself and by the widespread applications of such construction in various sciences such as physics, mechanics, chemistry, and engineering. On the other hand, it is well known that the qualitative theory of differential equations can be very useful in applications. Much attention has been given to the notions of stability, oscillation, asymptotic, existence, and uniqueness theory of differential equations over the past decades. The explosion in research within the fractional differential equation settings has led to new developments in qualitative theory of fractional differential equations. Indeed, it is well known that the analysis of fractional differential equations is more complex than that of classical differential equations, since fractional derivatives are nonlocal and have weakly singular kernels. Therefore, the development of qualitative theory, especially oscillation, of nonlinear fractional differential equations has been slowly developed a bit slow.

This issue on recent developments and applications on qualitative theory of fractional equations and related topics aims to provide a wide survey on the notions of stability, existence, uniqueness, and oscillation theory of differential equations of noninteger order, on the development of numerical methods for such equations, and on the numerical simulation and convergence analysis for qualitative theory of fractional differential equations and their applications. This issue contains many fascinating papers of different disciplines, most of them focusing on the existence, uniqueness, and multiplicity of solutions, solvability, stability, and oscillation for fractional differential equations and discrete fractional equations.

The existence, uniqueness, and multiplicity of solutions are considered to be fundamental in the study of fractional differential equations. Y. Cui and Y. Zou discuss the existence of extremal solutions for nonlinear fractional differential systems with coupled four-point boundary value problems by establishing a comparison result and using the monotone iterative technique combined with the method of upper and lower solutions. L. Wang et al. investigate the existence of positive solutions for a class of singular p-Laplacian fractional differential equations with integral boundary conditions by using the Leggett-Williams fixed point theorem and obtained some sufficient conditions for the existence of at least three positive solutions. D. Yang studies the existence of solutions of second-order three-point boundary value problems with impulse by constructing a variational functional of the boundary value problem and using the critical point theory. M. Yang and A. Li, concerned with the multiplicity of solutions to elliptic equations with combined nonlinearities and parameter, discuss two sufficient conditions for multiple nontrivial radial solutions in terms of the range of the parameter. W. Jian and H. Sun consider eigenvalues of complex Sturm-Liouville boundary value problems. Lower bounds on the real parts of all eigenvalues are given in terms of the coefficients of the corresponding equation and the bound on the imaginary part of each eigenvalue is obtained in terms