Journal of Mathematics

Special Issue on

New Trends in Special Functions and Real Analysis for Solving Complex Problems

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Many times during the solution of complex problems in engineering, we treat them with important functions defined by improper integrals and series (or infinite products). Those functions are generally called special functions. Special functions contain a very old branch of mathematics. For example, trigonometric functions have been studied for over a thousand years, due mainly to their numerous applications in astronomy. Yet the origins of their unified and rather complete theory date back to the nineteenth century. From application points of view, special functions as important mathematical tools rest on, due to their remarkable properties, usefulness for the applied scientists and engineers, as Paul Turan once remarked that special functions would be more appropriately labeled useful functions. Various special functions like Bessel and all cylindrical functions; the Gauss, Kummer, confluent, and generalized hypergeometric functions; the classical orthogonal polynomials, the incomplete Gamma and Beta functions and error functions; the Airy and Whittaker functions; and so on will provide solutions to integer order differential equations and systems, used as mathematical models. However, recently there have been an increasing interest in and widely extended use of differential equations and systems of fractional order (that is, of arbitrary order), as better models of phenomena of various physics, engineering, automatization, biology and biomedicine, chemistry, earth science, economics, nature, and so on. Now, new unified presentation and extensive development of special functions associated with fractional calculus (branch of mathematical analysis) are necessary tools, being related to the theory of differentiation and integration of arbitrary order (i.e., fractional calculus) and to the fractional order (or multiorder) differential and integral equations.

This issue provides learners with the opportunity to develop an understanding of special functions and the skills needed to apply advanced mathematical techniques to solve complex engineering problems. Subject matters should be strongly related to special functions involving mathematical analysis and its numerous applications. The main objective of this special issue is to highlight the importance of fundamental results and techniques of the theory of mathematical analysis and emphasizes articles devoted to the mathematical treatment of questions arising in physics, chemistry, biology, and engineering, particularly those that stress analytical aspects and novel problems and their solutions. We seek high-quality original research papers, as well as review papers related to the topic of this issue.

Potential topics include but are not limited to the following:

- Sequence and series in functional analysis
- Special functions related to fractional (noninteger) order control systems and equations
- Various special functions related to generalized fractional calculus
- Operational method in fractional calculus
- Functional analysis and operator theory
- Applications of numerical analysis and applied mathematics
- Mathematical modelling
- Fixed point theory

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praveen.agarwal@anandice.ac.in

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q.almdallal@uaeu.ac.ae

Vu K. Tuan, University of West Georgia, Carrollton, USA
vu@westga.edu

Mustafa Bayram, Istanbul Gelisim University, Istanbul, Turkey
mbayram@gelisim.edu.tr

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