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Editorial

Higher Transcendental Functions and Their Multi-Disciplinary Applications

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1. Introduction

This volume consists of a collection of 17 peer-reviewed and accepted submissions from authors around the world (including several invited feature articles) to the Special Issue of the journal *Mathematics*, on the general subject-area of "Higher Transcendental Functions and Their Multi-Disciplinary Applications".

The origin of the higher transcendental functions, also known as mathematical functions and special functions, can be traced back to several extensively investigated areas, such as mathematical analysis, mathematical physics, analytic number theory, applied mathematical sciences, and other fields.

In this Special Issue, we invited and welcome review, expository, and original research articles dealing with the recent advances on various potentially useful families of special functions (or, more precisely, higher transcendental functions) of mathematical analysis, mathematical physics, analytic number theory, and the geometric function theory of complex analysis, as well as their applications in many widely-scattered disciplines within the physical, biological, chemical, earth, engineering, and statistical sciences.

In the recent, as well as in the current literature, several higher transcendental functions are also involved in the theory and applications of various families of fractional-order integral operators and the corresponding fractional-order derivative operators, such as those named after Riemann-Liouville, Weyl, Hadamard, Grünwald-Letnikov, Riesz, Erdélyi-Kober, Liouville-Caputo, and so on, each of which has been found to be remarkably important and fruitful, due, mainly, to their demonstrated applications in numerous seemingly diverse and widespread areas of the mathematical, physical, chemical, engineering, and statistical sciences. Many of these fractional-order operators provide interesting and potentially useful tools for solving ordinary and partial differential equations, as well as integral, differ-integral, and integro-differential equations, fractional-calculus analogues, and extensions of each of these equations, and various other problems involving special functions of mathematical physics and applied mathematics, as well as their extensions and generalizations in one or more variables.

2. An Overview of the Special Issue

As it is known fairly well, investigations involving the theory and applications of higher transcendental functions and their associated families of integral transformations

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and operational calculus are remarkably widespread in many diverse areas of the mathematical, physical, chemical, engineering, and statistical sciences. In this Special Issue, we invited and welcome review, expository, and original research articles dealing with the recent state-of-the-art advances on the topics involving various families of potentially useful special functions (or, more precisely, higher transcendental functions) of mathematical analysis, mathematical physics, analytic number theory, the geometric function theory of complex analysis, integral transformations and operational calculus.

The suggested topics of interest for the call of papers for this Special Issue included, but were not limited to, the following keywords:

- Mathematical (or higher transcendental) functions and their applications;
- Fractional-order derivatives and integrals and their applications;
- q-Differences (or q-derivatives);
- q-Series and q-polynomials;
- Functions of analytic number theory;
- Special functions of mathematical physics and applied mathematics;
- Geometric function theory of complex analysis;
- Integral transformations, and integral and integro-differential equations, as well as other related operators of fractional calculus.

A considerably large number of well-established international scientific research journals, which are published by such publishers as (for example) Elsevier Science Publishers, John Wiley and Sons, Hindawi Publishing Corporation, Springer, De Gruyter, Taylor and Francis, MDPI, and other widely-recognized publishing houses, have published and continue to publish a number of Special Issues of many of their journals on recent and state-of-the-art advances on various multidisciplinary aspects, especially of the subject of one or the other of the above-mentioned keywords.

3. Contributors and Contributions to the Special Issue

The geographical distribution of the contributors to this Special Issue is remarkably widely-scattered. Their contributions (see [1–17]) originated in many different countries on every continent of the world.

The subject matter of the first 16 publications (see [1–16]) dealt extensively with analytic, univalent, multivalent, and harmonic functions of complex analysis and their quantum or basic (or q-) extensions, the Euler-Poisson-Darboux partial differential equation, approximation theory and associated summability methods, variational inequalities, linear and nonlinear integro-differential equations, growth results involving Dirichlet series, theory and applications of wavelet transforms, analysis of ordinary and partial differential-difference equations, and several other topics listed in the preceding section.

Reference [17] happens to be an invited survey-cum-expository review article which contains a brief and comprehensive account of some general families of linear and bilinear generating functions associated with orthogonal polynomials and such other higher transcendental functions as (for example) hypergeometric functions and hypergeometric polynomials in one, two and more variables. Many of the results, as well as the methods and techniques used for their derivations, which are presented in [17], are intended to provide incentive and motivation for further research on the subject reviewed in [17].

It may be of interest to remark in conclusion that the above-mentioned work [17] is, in some sense, motivated by an earlier survey-cum-expository review article [18] which presented a brief introductory overview and survey of some of the recent developments in the theory of several extensively-studied higher transcendental functions and their potential applications. It is in [18] in which the interested reader can find some developments involving a hybrid version of several known extensions and generalizations of the Mittag-Leffler type functions, as well as the Hurwitz-Lerch type zeta functions, together with its associated fractional integrals and fractional derivatives (see, for details, [19,20]; see also [21]).

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