

# BOUNDARY VALUE PROBLEMS AND THEIR APPLICATIONS ON BIOSCIENCES AND ENGINEERING

## GUEST EDITORS

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Salah Boulaaras (Lead Guest Editor), Qassim University, Saudi Arabia, [s.boulaaras@qu.edu.sa](mailto:s.boulaaras@qu.edu.sa), [saleh\\_boulaares@yahoo.fr](mailto:saleh_boulaares@yahoo.fr)

Mohamed Abdalla, King Khalid University, Saudi Arabia, [moabdalla@kku.edu.sa](mailto:moabdalla@kku.edu.sa)

Baowei Feng, Southwestern University of Finance and Economics, China, [bwfeng@swufe.edu.cn](mailto:bwfeng@swufe.edu.cn)

Aldo Jonathan Munoz-Vazquez, Texas A&M University, USA, [aldo.munoz-vazquez@tamu.edu](mailto:aldo.munoz-vazquez@tamu.edu)

## DESCRIPTION

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Over the last thirty years the theory of generalized special functions has proved its importance in a variety of fields from theoretical to practical issues in biosciences and engineering. It has been developed for decades as a generalization of the special function theory in the complex plane to higher dimensions and also considered as a refinement of classical harmonic analysis. There are several approaches, in which such generalization can be performed: one is the theory of matrix functions, and the other is to use Clifford algebras, what is nowadays called Clifford analysis. A standard example is quaternionic analysis, which is particularly adequate for the treatment of three- and four-dimensional structures. In particular, the starting point of a quaternionic function theory is the consideration of null-solutions of particular systems of first order partial differential equations (PDEs), such as the Cauchy- Riemann equation or a Dirac equation, in Euclidean spaces; they are known as monogenic functions.

This thematic special issue in *Open Mathematics* distinct parts in the following two proposed cases:

1. Regarding the first case a lot of results concerning matrix functions have been carried out by several researchers (e.g., L. Jodar, J. Cortes, A. James, A. Mathai and H. Dhimi). It is well-known that special matrix functions are closely connected with statistics, mathematical physics, biosciences and engineering, theoretical physics, group representation theory, Lie group's theory, orthogonal matrix polynomials, and so forth. The theory and application of scalar orthogonal polynomials are elegant, extensive and diverse, with important results dating back to fundamental works by Hermite, Chebyshev, Jacobi, Laguerre, Gegenbauer and Bessel Polynomials, among many others. Looking at a possible extension of the Classical families of Hermite, Chebyshev, Jacobi, Laguerre and Gegenbauer polynomials to a matrix framework, a lot of results have been already introduced and studied in a large number of papers. Some developments of such a work have to be considered with the purpose of improving already existing results and to give other possible generalizations.

2. Regarding the second case, one can say that this idea is natural since monogenic functions share a lot of properties with complex holomorphic functions in the complex one-dimensional case. So far, the relationships between the hypercomplex families and different forms of the Laplace equation have been treated. In particular, the four-dimensional Laplace equations is factored using quaternionic differential operators. The outcome are new classes of hypercomplex functions including Fueter's regular functions. It is shown that each class contains differentiable functions and is directly applied to the derivation of analytical solutions of important PDEs in mathematical physics such as the Helmholtz, Maxwell, Schrödinger, Klein-Gordon, Lamé and Stokes (later Navier-Stokes) equations.

We invite researchers to submit original research articles as well as review articles on the recent development in the special functions, boundary value problems, partial differential equations, electromagnetic theory

Potential topics include (but are not limited to) the following:

- ▶ Special functions transform and/or simplify (special) PDE
- ▶ Elasticity Boundary Value Problems and their application in Engineering
- ▶ Application of the monogenic functions properties to the construction of orthonormal lattices on general surfaces as a basis for numerical approximations in Biosciences
- ▶ Construction of special functions to solve the Lamé and the Stokes equations and its application in Engineering
- ▶ Stress and stream special functions
- ▶ Nonlocal complex Choquard problems in special functions and their application in biosciences
- ▶ Critical behavior for nonlinear evolution equations and their application on biosciences and engineering Classification and clustering
- ▶ Critical complex problems and its application on biosciences and engineering

Authors are requested to submit their full revised papers complying the general scope of the journal. The submitted papers will undergo the standard peer-review process before they can be accepted. Notification of acceptance will be communicated as we progress with the review process.

## HOW TO SUBMIT

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Before submission authors should carefully read the [Instruction for Authors](#).

Manuscripts can be written in TeX, LaTeX (strongly recommended) - the journal's [LATEX template](#). Please note that we do not accept papers in Plain TEX format. Text files can be also submitted as standard DOCUMENT (.DOC) which is acceptable if the submission in LATEX is not possible. **For an initial submission, the authors are strongly advised to upload their entire manuscript, including tables and figures, as a single PDF file.**

All submissions to the Special Issue must be made electronically via online submission system Editorial Manager: [www.editorialmanager.com/openmath](http://www.editorialmanager.com/openmath).

All manuscripts will undergo the standard peer-review process (single blind, at least two independent reviewers). When entering your submission via online submission system please choose the option "*Special Issue on Boundary Value Problems and their Applications on Biosciences and Engineering*".

Submission of a manuscript implies that the work described has not been published before and it is not under consideration for publication anywhere else.

**The deadline for submissions is 30<sup>th</sup> September 2021**, but individual papers will be reviewed and published online on an ongoing basis.

Contributors to the Special Issue will benefit from:

- ▶ critical peer-review
- ▶ no space constraints
- ▶ quick online publication upon completing the publishing process (**continuous publication model**)

- ▶ content converting to xml
- ▶ better visibility due to **Open Access** – free, unrestricted and permanent access to all the content
- ▶ **liberal policies on copyrights** (authors retain copyrights) and on self-archiving (no embargo periods)
- ▶ promotion of published papers to readers and citers
- ▶ **long-term preservation** – content archiving with Portico

We are looking forward to your submission!

In case of any questions please contact:

**Prof. Salah Boulaaras** (Lead Guest Editor), [s.boulaaras@qu.edu.sa](mailto:s.boulaaras@qu.edu.sa), [saleh\\_boulaares@yahoo.fr](mailto:saleh_boulaares@yahoo.fr)

**Dr. Justyna Żuk** (Managing Editor), [Justyna.Zuk@degruyter.com](mailto:Justyna.Zuk@degruyter.com)