Editorial

Well-Posed and Ill-Posed Boundary Value Problems for PDE

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The studies of well-posed and ill-posed local and nonlocal boundary value problems for partial differential equations are driven not only by a theoretical interest but also by the fact that several phenomena in engineering, various fields of physics and financial mathematics can be modeled and investigated in this way.

The present special issue is devoted to the publication of high-quality research papers in the fields of the construction and investigation of analytic and numerical methods for solutions of well-posed and ill-posed boundary value problems for partial differential equations.

The issue covers a wide variety of problems for different classes of ordinary and partial differential equations, as well as dynamic equations on time scales. The topics discussed in the contributed papers are traditional for qualitative theory of differential equations. The issue contains papers on the global well-posedness of the viscous two-component Camassa-Holm system, local and global existence of solutions for a generalized Camassa-Holm equation, global solutions for the Cauchy problem of a Boussinesq-type equation, exact asymptotic expansion of singular solutions for the $(2 + 1)$-D Protter problem, on the regularity for variational evolution integrodifferential in equalities, right-hand side identification problem arising in biofluid mechanics, regularized solutions of optimal control problem in a hyperbolic system, generalized localization of Fourier inversion associated with an elliptic operator for distributions and Kamenev-type oscillation criteria for the second-order nonlinear dynamic equations with damping on-time scales. Furthermore, classification

of exact solutions for some nonlinear partial differential equations with generalized evolution is presented.

A number of papers are concerned with well-posedness of partial differential and difference equations. Interesting stability results are obtained for nonlocal boundary value problems for hyperbolic Schrödinger equations, difference schemes of ultraparabolic equations and reverse parabolic problem, approximate solutions of delay parabolic equations with the Dirichlet condition, difference problem of obtaining the parameter of a parabolic equation, integral-differential equation of the parabolic type in a Banach space, the first and second order of accuracy stable implicit different schemes for elliptic-parabolic equations in Hölder spaces, the second order of accuracy stable difference schemes for the nonlocal boundary value hyperbolic problem, and the numerical solution of the Bitsadze-Samarskii nonlocal boundary value problems with the Dirichlet-Neumann condition. Moreover, applications of generalizations of Wendroff integral inequalities and their discrete analogues and operator approach to investigate for stability of hyperbolic equations are presented. Two papers collected in this special issue address construction and investigation of difference schemes for numerical solutions of stochastic parabolic and hyperbolic equations.

Several authors deal with different aspects of the theory of boundary value problems for fractional ordinary and partial differential equations. Interesting existence and uniqueness results are obtained for a class of nonlinear fractional differential equations, system of nonlinear fractional differential equations with nonlocal and integral boundary conditions, fractional partial differential equations of higher order. Moreover, applications of operator approach to investigate for stability of difference schemes for fractional parabolic partial differential equations with the Dirichlet-Neumann conditions and well-posedness of the inverse problem for a fractional parabolic equation are presented.

Two papers collected in this special issue address spectrum of differential operators and its applications for nonlinear Euler buckling problem and asymptotic solutions of singular perturbed problems with an unstable spectrum of the limiting operator. Moreover, basis properties of eigenfunctions of second-order differential operators with involution, and spectral properties of non-self-adjoint perturbations for a spectral problem with involution are presented. Finally, some applied problems are also considered—an efficient variational approach for deformable registration of images, and an inverse scattering from a sound-hard crack via two-step method.

This volume was a collection of 36 accepted manuscripts by 61 authors. The selection of the papers included in this volume was based on an international peer-review procedure. The accepted manuscripts examine wide ranging and cutting edge developments in various areas of well-posed and ill-posed local and nonlocal boundary value problems for partial differential equations. The papers give a taste of current research. We feel the variety of topics will be of interest to both graduate students and researchers.

Further, we are very grateful to all authors for sending their new papers for the publication in the present special issue.

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