

This special issue represents a wide range of topics related to both theoretical challenges arising in the analysis of dynamical systems as well as a variety of applications. A number of the papers included here are related to presentations given at the Fourth International Conference on Dynamical Systems and Applications, DSA IV, held at the Lodz University of Technology on June 16-18, 2016. This series was established in 2013 and successfully continues to bring together researchers from the US and the European research environment.

Going briefly through some highlights of the more theoretical papers, discrete systems are one of the prominent topics because of the growing research interest in this area. Properties of solutions to discrete systems with the use of fixed point methods are investigated including the existence of uncountably many solutions as well as the existence and non-existence of monotonic solutions. Abstract tools from optimal control theory are applied to fractional difference equations. The beam equation is considered within the scheme of Galerkin type approximations for the related optimal control problem.

For problems in contact mechanics, numerical tools are developed and successfully applied. Two new abstract tools are derived, one being a higher order invertibility theorem with applications to boundary value problems and the other an Arzela-Ascoli compactness type theorem. Constrained semilinear evolution inclusion of parabolic type involving an m -dissipative linear operator in a Banach space and topological properties of the solution map are presented. The asymptotic properties of Dickman equation arising in number theory are investigated.

The volume also includes interesting topics in PDE, both nonlocal and nonlinear equations. Self-similar solutions are established for the equation of fragmentation and the mountain pass theorem is used to determine solutions to superlinear equations with the fractional Laplacian. For nonlinear equations, including a parabolic approximation to the nonlinear Schrödinger equation and systems with p -Laplacian, proofs of the existence of solutions are presented. In other topics, homoclinic solutions for second order divergence equations are presented as well as countably many constant solutions to a discrete system. A bridge between theory and applications is presented in a paper describing free boundary problems arising in biology.

On a more applied note, maps defining discrete dynamical systems on the 2-dimensional simplex arising from the rock-paper-scissors game in cases of three possible strategies (revenge, treason and mixed) are analyzed. More on the side of physics, the existence of multiple radial solutions to an elliptic equation modeling a fermionic cloud of interacting particles is proved for the limiting Planck constant with intermediate values of mass parameters. Finally, an interesting stochastic model of threat and defense is presented and analyzed.

Going into mathematics of social behaviors, the time evolution of the emotional states of two persons during a short meeting leads to a continuous dynamical system in the plane with interesting stability features. The question of existence and uniqueness of a stationary density for path integral Markov semigroups in L_1 -spaces as well as the investigation of the effects of assortative mating on phenotype distributions are addressed.

Biomedical applications are well represented with a large number of papers devoted to tools and methods of both dynamical systems, PDEs and optimal control in the analysis of models arising in biomedicine. The models and topics include: delayed HIV model, combined chemo and anti-angiogenic therapies for cancer, combination virotherapy for glioma and optimizing treatments for CML (chronic myeloid leukemia). Similar tools and methods were also employed in the analysis of models in epidemiology which take into account the combined intervention by vaccination and treatment.

Overall, the volume represents a mix of theory and applications in the fields of discrete and continuous differential equations and dynamical systems. As such it provides a contribution to the DCDS series B and its mission. We hope that readers will find the presented topics both interesting and stimulating in their own research.

Guest Editors,

Urszula Ledzewicz, Pavel Drabek, Avner Friedman, Marek Galewski, Maria do Rosario de Pinho, Bogdan Przeradzki, Ewa Schmeidel