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Editorial

Control, Stability, and Qualitative Theory of Dynamical Systems

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Dynamical systems play a crucial role in the mathematical modeling of phenomena across disciplines. Understanding issues concerning controllability, stability, and other qualitative aspects of such systems is important in enhancing our understanding of the mathematical models described by these systems. This issue compiles 18 manuscripts covering various aspects of deterministic and stochastic dynamical systems theory and its applications. Elements of the theory and techniques from dynamical systems, control and optimal control theory, stochastic analysis, and stochastic evolution equations are used throughout these papers to establish an impressive collection of results. The results established in all articles in this issue have application in multiple disciplines, and they often contain replicable numerical analysis components that could have broader applicability.

On the more abstract end of the spectrum, two papers explore theoretical issues arising in deterministic and stochastic fractional differential equations. Specifically, H. Aktuglu et al. established existence results for Caputo fractional BVPs and G. Shen et al. studied the Holder regularity in local time of the fractional Ornstein-Uhlenbeck process; both have applications in diffusion, finance, and econophysics. Two papers focus on abstract optimal control problems: A. R. Safari et al. establish a maximum principle for abstract systems with integral boundary conditions arising in the mathematical modeling of heat conduction and plasma physics, while S. Meherrem and R. Akbarov study the role that exhausters and quasidifferentiability play in switching control problems arising in the mathematical study of chemical processes, automotive systems, and circuit theory. One paper, by X. Qin, focuses on the stabilization of a class of stochastic nonholonomic system, which involved constructing a smooth state-feedback control law that ensures certain stochastic properties of the solution. Also, Y. Li and Y. Zhao study tracking control and synchronization of the hyperchaotic Lorenz-Stenflo system, which contributes to the growing literature in that direction.

Three papers study control problems for very different systems (networks, deterministic systems, and stochastic systems), all with time delays. B. Wang and Y. Sun investigated control problems for a multiagent system with heterogeneous delays in directed networks; A. E. Bashirov and M. Jneid established partial complete controllability results for abstract deterministic systems; and X. Zhou et al. studied the BIBO stabilization in the mean square for discrete-time stochastic systems. All of these results have significant applicability for mathematical models involving the respective type of system.

Qualitative results involving the notion of periodicity were established in two of the papers. D. de C. Braga et al. studied the approximation of periodic orbits for dynamical systems of the type arising in the circuit analysis and mathematical ecology. G. Ge and W. Wang established period-doubling bifurcation results for feedback control systems of damped linear oscillators.

Finally, on the more applied end of the spectrum, nearly half of the papers in this issue study more concrete systems arising in the mathematical models from population ecology, mathematical biology, and mathematical finance. Two papers focus on different aspects of the SIRS epidemic model: W. Liu studied the SIRS model with random perturbations, while