Editorial

DYNAMIC EQUATIONS AND APPLICATIONS

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Dedicated to Professor Gusein Guseinov on the occasion of his 55th birthday

Going back to its founder *Stefan Hilger* (1988), the study of dynamic equations on time scales is a fairly new area of mathematics. Motivating the subject is the notion that dynamic equations on time scales can build bridges between continuous and discrete mathematics. Time is considered to be an element of an arbitrary closed subset of the reals, the so-called time scale. Dynamic equations on the time scale of all real numbers are differential equations, while dynamic equations on the time scale of all integers are difference equations. But not only is this theory able to *unify* the continuous and the discrete, it also can help to *extend* these theories to cases "in between" and to other dynamic equations (e.g., q-difference equations). The study of time scales theory has led to several important applications, for example, in the study of insect population models, neural networks, heat transfer, quantum mechanics, and epidemic models.

This special issue on *Dynamic Equations and Applications* features fifteen articles by some of the top researchers in time scales worldwide. The impressive list of twenty-five contributors from eight different countries includes Elvan Akın-Bohner (USA), Douglas Anderson (USA), Mouffak Benchohra (Algeria), Martin Bohner (USA), Alberto Cabada (Spain), Fordyce Davidson (United Kingdom), Lynn Erbe (USA), Nicole Garbers (Germany), Gusein Guseinov (Turkey), Samira Hamani (Algeria), Johnny Henderson (USA), Gro Hovhannisyan (USA), Basant Karna (USA), Peter Kloeden (Germany), Bonita Lawrence (USA), Allan Peterson (USA), Christian Pötzsche (USA), Youssef Raffoul (USA), Pavel Řehák (Czech Republic), Andreas Ruffing (Germany), Bryan Rynne (United Kingdom), Yeter Şahiner (Turkey), Samir Saker (Egypt), Petr Stehlík (Czech Republic), and Alexandra Zmorzynska (Germany).

We would like to dedicate this special issue to *Professor Gusein Guseinov on the occasion of his 55th birthday.* Professor Guseinov received his Ph.D. degree from Moscow State University in 1977 and was Head of the Department "Spectral Theory of Operators" at the Azerbaijan Academy of Sciences before joining Ege University (Izmir, Turkey) in 1993 and Atilim University (Ankara, Turkey) in 2001.

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Thinking about nonlinearity in engineering areas, up to the 70s, was focused on intentionally built nonlinear parts in order to improve the operational characteristics of a device or system. Keying, saturation, hysteretic phenomena, and dead zones were added to existing devices increasing their behavior diversity and precision. In this context, an intrinsic nonlinearity was treated just as a linear approximation, around equilibrium points.

Inspired on the rediscovering of the richness of nonlinear and chaotic phenomena, engineers started using analytical tools from "Qualitative Theory of Differential Equations," allowing more precise analysis and synthesis, in order to produce new vital products and services. Bifurcation theory, dynamical systems and chaos started to be part of the mandatory set of tools for design engineers.

This proposed special edition of the *Mathematical Problems in Engineering* aims to provide a picture of the importance of the bifurcation theory, relating it with nonlinear and chaotic dynamics for natural and engineered systems. Ideas of how this dynamics can be captured through precisely tailored real and numerical experiments and understanding by the combination of specific tools that associate dynamical system theory and geometric tools in a very clever, sophisticated, and at the same time simple and unique analytical environment are the subject of this issue, allowing new methods to design high-precision devices and equipment.

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