ABSTRACT BOOK

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Contents

Program

Program

Degenerate Identification Problems with Smoothing Overdetermination

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We are concerned with degenerate first-order identification problems with smoothing overdetermination in abstract spaces. A projection method and suitable hypotheses on the operators involved are used in order to reduce the given problem to a non-degenerate problem. Then perturbation theory for linear operators is used to solve the regular problem. The introduced identification method permits one to solve the problems under the minimum restrictions on the input data. Applications to degenerate differential equations of the Sobolev type are indicated extending well-known results in the regular case. The abstract theory is then applied to obtain identi.ability results for degenerate systems arising in mathematical physics.

Key words and phrases: Identification Problem; Degenerate Differential Equations; Projection Method; Perturbation for Linear Operators.

An Asymptotic Model for the Stoneley Wave

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The "$formalsymmetry$" method of MSS1991 is based on the existence of a formal Laurent series R, in inverse powers of the derivative operator D, satisfying the operator equation $R_t + [R, F_*] = 0$, where F_* is the Frechet derivative of F. We apply this method to the classification of scalar evolution equations in one space dimension, of the form $u_t = F$. The existence of such a formal series leads to an infinite sequence of conservation laws for the so called "*canonical densities*", denoted here as $p_i, i = -1, 0, 1, \ldots$. In particular, for any mth order evolution equation, the quantity $p_{(-1)} = (\frac{\partial F}{\partial u_m})^{-1/m}$ is conserved. We have shown that integrable equations of order greater than or equal to 7, are quasi-linear. There is however is a non quasi-linear candidate of integrable equation of order 5. This equation is characterized by the triviality of the canonical density $p_{(3)}$. Those evolution equations for which the canonical density $p_{(3)}$ is trivial are called "*Sawada-Kotera and Kaup type*" equations because for these two hierarchies the conserved densities of orders multiples of 3 are trivial. This equation is of the form

$$u_t = -\frac{3}{2A}(Au_5 + B)^{-2/3} + C,$$

where the functions A, B and C are independent of u_5, and A and C are independent of u_4. A sequence of evolution equations of orders $m = 7, 11, 13, 17$ that are non-polynomial in u_5 are obtained and it is shown that their canonical densities are the same, suggesting that they belong to the same hierarchy.

Classical and quantum ODE's in Hamiltonian Mechanics

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We define a class of ODEs which describe classical and quantum Hamiltonian evolution. Then, we describe the properties of their solutions, i.e. related classical and quantum flows. Finally we show how to derive the time evolution of measurable quantities of the model, so called expectation values of observables.

Between continuous and discrete problems

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The main goal of the lecture is to discuss some problems connected with discrete and continuous mathematical models. It is known, that both models are useful and considered in practice. But sometimes they give different results and we need to move between them.

The main question is how do it? There is a few approaches. We will discuss some advantages and disadvantages of known methods. Some open problems will be presented.

References:

[1] M. Cichoń, B. Satco, Measure differential inclusions-between continuous and discrete, Advances in Difference Equations 2014 (2014): 1–18.

[2] M. Cichoń, B. Satco, A. Sikorska-Nowak, Impulsive nonlocal differential equations through differential equations on time scales, Applied Mathematics and Computation 218 (2011): 2449–2458.

[3] M. Cichoń, A. Yantir, On continuous dependence of solutions of dynamic equations, Applied Mathematics and Computation 252 (2015): 473–483.

[4] A. Slavík, Dynamic equations on time scales and generalized ordinary differential equations, Journal of Mathematical Analysis and Applications 385 (2012): 534–550.

Schwarz Problem For Nonlinear Equations in Unbounded Domains

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In this study one of the new techniques is used to solve numerical problems involving integral equations known as regularized sinc-collocation method. This method has been shown to be a powerful numerical tool for finding accurate solutions. So, in this talk, some properties of the regularized sinc-collocation method required for our subsequent development are given and are utilized to reduce integral equation of the first kind to some algebraic equations. Then by a theorem we show error in the approximation of the solution decays at an exponential rate. Finally, numerical examples are included to demonstrate the validity and applicability of the technique.

Matrix Representations of Sturm-Liouville Problems with Delta Interaction for Coupled Boundary Conditions

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We know from the Sturm-Liouville theory that the spectrum of a self-adjoint Sturm-Liouville problem is infinite. However, under the some restrictions, it has shown in [1] and [2] that the self-adjoint Sturm-Liouville problems have finite spectrum. In addition, we can see from the [3] and [4] that this kind of Sturm-Liouville problems are equivalent to a finite dimensional matrix eigenvalue problem. Namely, the Sturm-Liouville problem has exactly the same eigenvalues as the matrix eigenvalue problem. In this study, we will show that the Sturm-Liouville problems with $\delta-$interaction are also equivalent to a finite dimensional matrix eigenvalue problem for coupled boundary conditions.

References:

[1] Q. Kong, H. Wu and A. Zettl, Sturm-Liouville problems with finite spectrum, J. Math. Anal. and Appl. 263 (2001), 748-762

[2] J.J. Ao, J. Sun, M.Z. Zhang, The finite spectrum of Sturm-Liouville problems with transmission conditions, Appl. Math. and Comput. 218 (2011) 1166-1173

[3] Q. Kong, H. Volkmer, A. Zettl, Matrix representations of Sturm-Liouville problems with finite spectrum, Results in Mathematics 54 (2009), 103-116

[4] J.J. Ao, J. Sun, M.Z. Zhang, Matrix representations of Sturm-Liouville problems with transmission conditions, Computers and Mathematics with Applications 63 (2012) 1335-1348

Key words and phrases: Sturm-Liouville Problems with $\delta-$interaction, Coupled Boundry Conditions, Matrix Eigenvalue Problem

Artificial Neural Network Solutions of First Order Linear Differential Equations

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Some artificial neural networks are capable of solving ordinary differential equations. In this work, the well-known artificial neural network called Multi Layer Perceptron (MLP) is utilized to retrieve numerical solutions of first order linear differential equations. The obtained results and the exact solution are compared for the first order linear differential equations. The comparison shows that MLP provides acceptable solutions.

References:

[1] M. Otadi, M.Mosleh, Numerical solution of quadratic Riccati differential equation by neural network, Mathematical Sciences, 5-3, (2011) 249-257.

[2] A. J. Meade, A. A. Fernandez, The numerical solution of linear ordinary differential equations by feedforward neural networks, Mathematical and Computer Modelling, 20 (1994) 191-257.

[3] A. Malek, R.S. Beidokhti, Numerical solution for high order differential equations using a hybrid neural network-optimization method, Applied Mathematics and Computation 183 (2006) 260-271.

[4] M. Kumar, N. Yadav, Multilayer perceptrons and radial basis function network methods for the solution of differential equations: A survey, Computer and Mathematics with Applications 62 (2011) 3796-3811.

[5] X. Li-ying, W. Hui, Z. Zhe-zhao, The algorithm of neural networks on the initial value problems in ordinary differential equations, Industrial Electronics and Applications, 2007.

[6] J. Fojdl, R.W. Brause, The performance of approximation ordinary differential equations by neural nets, Tools with Artificial Intelligence, 2008.

Key words and phrases: Ordinary Differential Equation, Feedforward Neural Network, Multi Layer Perceptron, Backpropogation algorithm.

Toroidal Surfaces

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We show that the 2-torus in $\mathbb{R}^3$ is a critical point of a sequence of functionals $\mathcal{F}_n$ $(n = 1, 2, 3, \cdots)$ defined over compact 2-surfaces (closed membranes) in $\mathbb{R}^3$. When the Lagrange function $\mathcal{E}$ is a polynomial of degree n of the mean curvature H of the 2-torus, the radii (a, r) of the 2-torus are constrained to satisfy $\frac{a^2}{r^2} = \frac{n^2 - n}{n^2 - n - 1}$, $n \geq 2$. A simple generalization of 2-torus in $\mathbb{R}^3$ is a tube of radius r along a curve α which we call it toroidal surface (TS). We show that toroidal surfaces with non-circular curve α do not provide minimal energy surfaces of the functionals $\mathcal{F}_n$ $(n = 2, 3)$ on closed surfaces. We discuss possible applications of the functionals discussed in this work on cell membranes.

Integrable Curves and Surfaces

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This work is a review of the authors' works on the integrable surfaces. The surfaces in $\mathbb{R}^3$ obtained through the use of the soliton techniques are called integrable surfaces. Integrable equations and their Lax equations possess certain symmetries. Infinitesimal versions of these symmetries are deformations which are responsible in constructing the integrable surfaces. There are four different types of deformations. The spectral parameter, the gauge, the generalized symmetries and integration parameters deformations. We shall present here how these deformations generate two surfaces in $\mathbb{R}^3$ and also in 3-dimentional Minkowski space. The key point here is to start with an integrable and it's Lax equations. In this work we assume that the Lax equations of integrable equations are given interms of a group G-valued and it's algebra $\mathfrak{g}$ valued functions. The surfaces in $\mathbb{R}^3$ are also represented with respect $\mathfrak{g}$ valued functions. In constructing integrable surfaces we need the solutions of both the integrable equations and their corresponding Lax equations. In this work we use the one soliton solutions of the integrable equations. We solve the Lax equations for one soliton solutions of the integrable equations. Then choosing a deformation one can construct several types of surfaces. After obtaining these surfaces the next is to search the properties of these surfaces. Most of these surfaces are Weingarten surfaces, Willmore-like surfaces and surfaces which are derivable from a variational principle. We give sketches of the interesting surfaces of mKdV, SG, NLSE and KdV equations.

Solution of Dirichlet Problem For a Square Region

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The steady state heat distribution in a square plane region is modeled by two dimensional Laplace equation. In this study, Dirichlet problem for the Laplace (also Poisson) differential equation in a square plane is expressed in terms of elliptic functions and the solution of the problem is based on the Green's function and therefore on elliptic functions. To do this, it is made use of the basic consepts associated with elliptic integrals, conform mappings and Green's functions.

References:

[1] V.V. Brovar, Z.S. Kopeikina, M.V. Pavlova, Solution of the Dirichlet and Stokes exterior boundaryproblems for the Earth.s ellipsoid, J. Geodesy 74 (2001) 767-772.

[2] M. Sezer, Solution of Dirichlet Problem in Terms of Elliptic Functions, Yıldız University Dergisi 4 (1992) 1-4.

[3] F. Lanzara, Numerical approximation of eigenvalues and of Green's operator for an elliptic boundary value problem, Calcolo 35 (1998) 63-92.

[4] A. Marshakov, P. Wiegmann, A. Zabrodin, Integrable structure of the Dirichlet boundary problem in two dimensions, Commun. Math. Phys. 227 (2002) 131-153.

[5] J.J. Han, N. Hasebe, Green's function for a thermomechanical mixed boundary value problem of infinite plane with elliptic hole, J. Thermal Stresses 24 (2001) 903-916.

[6] J.J. Han, N. Hasebe, Green's function of point heat sources in various thermoelastic boundary value problems, J. Thermal Stresses 25 (2002) 153-167.

[7] N. Kurt, M. Sezer, A. Çelik, Solution of Dirichlet problem for a rectangular region in terms of elliptic functions, J. Comput. Math. 81 (2004) 1417-1426.

[8] G.C. Hsiao, J. Saranen, Boundary integral solution of the two-dimensional heat equation, Math. Methods Appl. Sci. 16 (2) (1993) 87-114.

[9] L.N. Tao, The analyticity of solution of the heat equation with nonlinear boundary conditions, Quart. Mech. Appl. Math. 38 (1985) 447-459.

[10] O. Hansen, On a boundary integral method for the solution of the heat equation in unbounded domains with nonsmooth boundary, J. Integral Equation Appl. 12 (2000) 385-420.

[11] J.G. Saldana, J.A.J. Bernal, C.G. Torres, P.Q. Diez, Numerical solution for the one dimension heat equation by a pseudo-spectral discretization technique, Cienti.ca Instituto Politecnico Nacional, vol. 10, 2006, pp. 3-8.

[12] N.M. Al-Najem, A.M. Osman, M.M. El-Refaee, K.M. Khanafer, Two-dimensional steady-state inverse heat conduction problems, Int. Commun. Heat Mass Transfer 25 (1998) 541-550.

[13] N. Kurt, M. Sezer, Solution of Dirichlet problem for a triangle region in terms of elliptic functions, Appl.Math. Comput. 182 (2006) 73-78.

[14] G. Moretti, Functions of Complex Variable, Prentice-Hall, NJ, 1964.

[15] F.R. Hildebrand, Advanced calculusfor Applications, Prentice-Hall Inc. Englewood Clis, NJ,1976.

[16] P.R. Garabedian, Partial Differential Equations, John Wiley and Sons Inc.,New York,1964.

[17] N.Kurt, Solution of the two-dimensional heat equation for a square in terms of elliptic function. Journal of the Franklin institute, 2007.

Key words and phrases: Dirichlet problem; Elliptic functions; Elliptic integral; Green's function.

Invariant Subspace Method and Fractional Modified Kuramoto-Sivashinsky Equation

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In this talk, the invariant subspace method is applied to the time fractional modified Kuramoto-Sivashinsky partial differential equation. The obtained reduced system of nonlinear ordinary fractional equations is solved by the Laplace transform method and with using of some useful properties of Mittag-Leffler function. Then, some exact solutions of the time fractional nonlinear studied equation are found.

Analiticity of the Time Scales Exponential Function

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In this presentation, we will talk about the analyticity property of the time scales exponential function on the regressive Hilgers complex plane.

Almost Automorphic Solutions of Delayed Neutral Dynamic Systems on Time Scales

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We study the existence of almost automorphic solutions of the delayed neutral dynamic system

$$x^{\triangle}(t) = A(t)x(t) + Q^{\triangle}(t, x(t - g(t))) + G(t, x(t - g(t)))$$

on time scales that are additively periodic. We use exponential dichotomy and prove uniqueness of projector of exponential dichotomy to obtain some limit results leading to sufficient conditions for existence of almost automorphic solutions of neutral system. Unlike the existing literature we prove our existence results without assuming boundedness of the matrices $A^{-1}(t)$ and $(I+\mu(t)A(t))^{-1}$. Hence, we significantly improve the results in the existing literature. In addition to generalization, we obtained some results that are completely new for the discrete case. Finally, we also provide an existence result for almost periodic solutions of the system.

References:

[1] M. Adivar, H. C. Koyuncuoğlu and Y. N. Raffoul, Existence of periodic solutions in shifts $\delta_{\pm}$ neutral nonlinear dynamic systems, Appl. Math. Comput. 242 (2014), 328-339.

[2] S. Bochner, Continuous mappings of almost automorphic and almost periodic functions, Proc. Nat. Acad. Sci. U.S.A. 52 (1964), 907.910.

[3] C. Lizama and J. G. Mesquita, Almost automorphic solutions of dynamic equations on time scales, J. Funct. Anal. 265 (2013), no. 10, 2267.2311.

[4] A. Slavik, Product integration on time scales, Dynam. Systems Appl. 19 (2010), no. 1, 97.112.

[5] W. A. Veech, Almost automorphic functions on groups, Amer. J. Math. 87 1965 719.751.

Key words and phrases: Almost automorphic, almost periodic, exponential dichotomy, nonlinear neutral dynamic system, Krasnoselskii, unique projection.

Analytic Solution for Two Dimensional Laplace Equation with Dirichlet Boundary Conditions

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A fundamental equation of applied mathematics is Laplace equation. This equation models important phenomena in engineering and physics, such as steady-state temperature distributions, electrostatic potentials, and fluid flow, to name just a few. Laplace equation with satisfied boundary values is known as the Dirichlet problem. In this study, an alternative method is presented for the solution of two-dimensional heat equation in a rectangular region. In this method, the solution function of the problem is based on the Green's function, and therefore on elliptic functions.

References:

[1] V.V. Brovar, Z.S. Kopeikina, M.V. Pavlova, Solution of the Dirichlet and Stokes exterior boundaryproblems for the Earth.s ellipsoid, J. Geodesy 74 (2001) 767-772.

[2] M. Sezer, Solution of Dirichlet Problem in Terms of Elliptic Functions, Yıldız University Dergisi 4 (1992) 1-4.

[3] F. Lanzara, Numerical approximation of eigenvalues and of Green's operator for an elliptic boundary value problem, Calcolo 35 (1998) 63-92.

[4] A. Marshakov, P. Wiegmann, A. Zabrodin, Integrable structure of the Dirichlet boundary problem in two dimensions, Commun. Math. Phys. 227 (2002) 131-153

.

[5] J.J. Han, N. Hasebe, Green's function for a thermomechanical mixed boundary value problem of infinite plane with elliptic hole, J. Thermal Stresses 24 (2001) 903-916.

[6] J.J. Han, N. Hasebe, Green's function of point heat sources in various thermoelastic boundary value problems, J. Thermal Stresses 25 (2002) 153-167.

[7] N. Kurt, M. Sezer, A. Çelik, Solution of Dirichlet problem for a rectangular region in terms of elliptic functions, J. Comput. Math. 81 (2004) 1417-1426.

[8] G.C. Hsiao, J. Saranen, Boundary integral solution of the two-dimensional heat equation, Math. Methods Appl. Sci. 16 (2) (1993) 87-114.

[9] L.N. Tao, The analyticity of solution of the heat equation with nonlinear boundary conditions, Quart. Mech. Appl. Math. 38 (1985) 447-459.

[10] O. Hansen, On a boundary integral method for the solution of the heat equation in unbounded domains with nonsmooth boundary, J. Integral Equation Appl. 12 (2000) 385-420.

[11] J.G. Saldana, J.A.J. Bernal, C.G. Torres, P.Q. Diez, Numerical solution for the one dimension heat equation by a pseudo-spectral discretization technique, Cienti.ca Instituto Politecnico Nacional, vol. 10, 2006, pp. 3-8.

[12] N.M. Al-Najem, A.M. Osman, M.M. El-Refaee, K.M. Khanafer, Two-dimensional steady-state inverse heat conduction problems, Int. Commun. Heat Mass Transfer 25 (1998) 541-550.

[13] N. Kurt, M. Sezer, Solution of Dirichlet problem for a triangle region in terms of elliptic functions, Appl.Math. Comput. 182 (2006) 73-78.

[14] G. Moretti, Functions of Complex Variable, Prentice-Hall, NJ, 1964.

[15] F.R. Hildebrand, Advanced calculus for Applications, Prentice-Hall Inc. Englewood Clis, NJ,1976.

[16] P.R. Garabedian, Partial Differential Equations, John Wiley and Sons Inc.,New York,1964.

[17] N.Kurt, Solution of the two-dimensional heat equation for a square in terms of elliptic function. Journal of the Franklin institute,2007

Key words and phrases: Dirichlet conditions; Elliptic functions; Elliptic integral; Green's function.

Numerical Solution of Linear-Quadratic Optimal Control Problems for Switching System

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In this paper we obtained approach for the optimal switching control problem with unknown switching points, which it is described in reference [1],[2]. In the references [1], the authors are studied Decomposition of Linear-Quadratic optimal Control problems for Two- Steps Systems. In [1], the authors assumed the switching point t1 is fixed in the interval for state equation and boundary of the integral of minimization functional and it is given algorithm for solving Linear-Quadratic optimal Control problem. But in presented paper author assumed more general case, in the case of switching point is unknown and by using transformation, the main problem is reduced to the problem with known interval and unknown the boundary of the integral in minimization functional is reduced to the known one, which is defined in [1], [2]. It is given illustrated example at the end of the paper.Then by using Gradient Projection Method Algorithm, the problem is solved numerically by authors.

References:

[1] G. A. Kurina and Y. Zhou, Decomposition of Linear-Quadratic Optimal Control problems for Two-Steps Systems, Doklady Mathematics, 2011, Vol. 83, No.2, pp.275-277.

[2] G. Kurina, On Decompasition of Linear-Quadratic Optimal Control Problems for Two- Steps Descriptor Systems, 50th IEEE Conference on Decision and Control and European Control Conference, 2011, pp. 6705-6711.

[3] Sh. F. Maharramov, Necessary optimality Conditions for Switching Control System, American Institute for Mathematical Science, Journal of Industrial and Manegament Optimization, 6(2010), pp. 47-58.

Key words and phrases: Optimal control, switching system, numerical solution, finite approximation.

Life Span of Solutions of Fractional Schrödinger Equation

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We consider the initial value problem for the nonlocal in time nonlinear Schrödinger equation

$$iu_i + \triangle u = \lambda J^{\alpha}_{0|t}|u|^P, x \in \mathbb{R}^N, t > 0;$$

$$u(x, 0) = f(x), x \in \mathbb{R}.$$

Using the test function method, we derive a blow-up exponent. Then based on integral inequalities, we estimate the life span of blowing-up solutions.

Key words and phrases: Blow-up, life span, Riemann-Liouville fractional integrals and derivatives.

Linear and Nonlinear Integrable Systems with q-Deformed Dispersion

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We present several ideas in direction of physical interpretation of q- and f-oscillators as nonlinear oscillators. First we show that an arbitrary one dimensional integrable system in action-angle variables can be naturally represented as a classical and quantum f-oscillator. As an example, the semi-relativistic oscillator as a descriptive of the Landau levels for relativistic electron in magnetic field is solved as an f-oscillator. By using dispersion relation for q-oscillator we solve the linear q-Schrodinger equation and corresponding nonlinear complex q-Burgers equation. The same dispersion allows us to construct integrable q-NLS model as a deformation of cubic NLS in terms of recursion operator of NLS hierarchy. Peculiar property of the model is to be completely integrable at any order of expansion in deformation parameter around $q = 1$. If time allows I am going to discuss as another variation on the theme, the hydrodynamic flow in bounded domain. For the flow bounded by two concentric circles we formulate the two circle theorem and construct solution as the q-periodic flow by non-symmetric q-calculus. Then we generalize this theorem to the flow in the wedge domain bounded by two arcs. This two circular-wedge theorem determines images of the flow by extension of q-calculus to two bases: the real one, corresponding to circular arcs and the complex one, with q as a primitive root of unity. As an application, the vortex motion in annular domain as a nonlinear oscillator in the form of classical and quantum f-oscillator is studied.

Degenerate Coupled Multi-KdV Equations

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Traveling wave solutions of degenerate three-coupled and four-coupled KdV equations are studied. Due to symmetry reduction these equations reduce to one ODE, $(f\prime)^2 = P_n(f)$ where $P_n(f)$ is a polynomial function of f of degree $n = \ell + 2$, where $\ell \leq 3$ in this work. Here ℓ is the number of coupled fields. There is no known method to solve such ordinary differential equations when $\ell \leq 3$. For this purpose, we introduce a method which uses the Chebyshev's Theorem to solve the reduced equation. We find several solutions some of which may correspond to solitary waves.

In Memory of Gusein Guseinov

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Professor of Physics and Mathematics Hüseyin Şirin Hüseyin, whose name appears in his academic publications as Gusein Guseinov (Hüseyin Hüseyinov),was born in 1951 in Aksu, Azerbaijan. He began his academic career in 1976 as a Specialist in the Institute of Mathematics and Mechanics of the National Academy of Sciences, Azerbaijan, and in 1993 he was invited to Ege University as a Visiting Scholar through the initiative of the Turkish Scientific and Technological Research Foundation. In 2001 he was invited to join the Department of Mathematics at Atılım University, where he held the position of Professor until 2015.

Professor Hüseyin was the author of some 125 academic articles, published in more than a dozen different countries. His work has been cited by more than 2000 other scholars, and he participated in joint research projects and authored joint publications with academics in the United States, Europe and Asia. He was the originator of the field of Integral Theory on Timescales and also made significantcontributions in the following academic fields: Mathematical Analysis, Linear and Non-linear Functional Analysis, the Spectral Geometry of Reiman Manifolds, the Spectral Theory of Automorphic Functions, Direct and Inverse Spectral Problems in Differential and Difference Operators, Initial and Boundary Value Problems in Impulsive and Delay Differential and Difference Equations and Timescale Analysis of Dynamic Systems.

Having passed away from a sudden heart attack on March 20th, 2015, Professor Hüseyin Şirin Hüseyin was buried on March 22^{nd} in his birthplace, Aksu, in the Republic of Azerbaijan.

Robustness Analysis of State-dependent Impulsive Neural Networks

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In this talk, we address the global robust asymptotic stability of the equilibrium point for a more general class of neural networks introduced by Kosko (1988,1989) with variable time of impulses. The networks have been studied widely issuing from the fact that, they have many important applications in pattern recognition, signal processing, associative memory, and optimization problems. All of these applications tediously depend on dynamical behaviors of the network and require that the equilibrium point of the model is globally asymptotically stable. In addition to these, the instantaneous perturbations and abrupt changes in the voltages at certain instant, which are produced by circuit elements, are exemplary of impulsive phenomena that can affect the transient behavior of the neural networks. Therefore, impulsive neural networks which are neither purely continuous nor discrete have been widely considered. Moreover, in practical implementation of neural networks, the stability of networks can often be destroyed by its compulsory uncertainty issuing from the existence of modeling errors, external disturbance and parameter fluctuations. Additionally, several studies with interesting results examining robust stability analysis of neural networks were published in the literature. Hence, robustness of the designed network is an important phenomena and should be considered. In the light of above discussion, it is necessary to consider both impulsive phenomena and robustness of the neural networks. Besides, in the present talk, different from the most existing results, we introduce a more general class of neural networks related to the impulsive phenomena that happen at nonprescribed moments of time. The aim of defining this new class is that in the real world problems the impulses of many systems do not occur at fixed times but depends on the states of the systems, like for example, some circuit control systems, saving rate control systems and population control systems and so on. These types of systems are called state-dependent impulsive differential systems or impulsive systems with variable-time impulses. In the current talk, different from the most existing studies, we discuss robustness of the neural networks having impulse times at the hyper surfaces $\Gamma_k : t = \theta_k + \tau_k(x), k \in \mathbb{Z}$, not on the planes $t = \theta_k$ In order to analyze global robust asymptotic stability of such systems, first we reduce the system to an fix time impulsive system by means of $B--$ equivalence method, then we used an appropriate Lyapunov function and linear matrix inequality (LMI). We give one illustrative example to show the effectiveness of the theoretical results.

References:

[1] M. Şaylı, E. Yılmaz, Global robust asymptotic stability of variable-time impulsive BAM neural networks, Neural Networks 60 pp. 67-73, 2014.

[2] M. Şaylı, E. Yılmaz, Periodic solution for state-dependent impulsive shunting inhibitory CNNs with time-varying delays, Neural Networks 68 pp. 1-11, 2015.

[3] M. Akhmet, Principles of Discontinuous Dynamical Systems, Springer, New York, 2010.

[4] T. Yang, Impulsive Control Theory, Springer-Verlag, Berlin, 2001.

[5] C.Liu, C. Li, X. Liao, Variable-time impulses in BAM neural networks with delay, Neurocomputing 74 pp. 3286-3295, 2011.

[6] S. Arik, A new condition for robust stability of uncertain neural networks with time delays, Neurocomputing 128 pp. 476-482, 2014.

[7] Z. Huang, X. Luo, Q. Yang, Global asymptotic stability analysis of bidirectional associative memory neural networks with distributed delay and impulse, Chaos Solutions Fractals 34 pp. 878-885, 2007.

[8] P. Li, J. Cao, Z. Wang, Robust impulsive synchronization of coupled delayed neural networks with uncertainties, Physica A 373 pp. 261-272, 2007.

[9] Q. Zhou, L. Wan, Global robust asymptotic stability analysis of BAM neural networks with time delay and impulse: An LMI approach,Appl. Math. and Comp. 216 pp. 1538-1545, 2010.

[10] B. Kosko, Bidirectional associative memories, IEEE Trans. Syst. Man Cybern. 18 pp. 49-60, 1988.

[11] B. Kosko, Adaptive bidirectional associative memories, Appl. Opt. 26 pp. 4947-4960, 1989.

Dynamic Transitions of Quasi-Geostrophic Channel Flow

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The main aim of this talk is to describe the dynamic transitions in flows described by the two-dimensional, barotropic vorticity equation in a periodic zonal channel, one of the cornerstone dynamical model of the ocean and atmospheric circulation.

The equation admits a steady state solution which represents a zonal jet. In this talk, the recent advances in this problem which addresses the stability problem of the bifurcated periodic solutions will be considered. In particular, it will be shown that the modeled flow exhibits either a continuous or catastrophic transition as the basic zonal jet loses its stability.

On the Approximation Property of Dynamic Equations on Time Scales

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We give some dimension independent results of the regularity of the solutions of Monge-Ampère equation using variational methods.

Key words and phrases:

On the Approximation Property of Dynamic Equations on Time Scales

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The main goal of the talk is to propose a new approach to the problem of approximation of solutions for differential problems. A standard approach is based on discrete approximations. We replace it by a sequence of dynamic equations. In this talk, we investigate the convergence of closed sets being domains of considered problems, i.e. time scales. Then we apply our results for the study of an approximation property of dynamic equations. Our results allow us to characterize a set of solutions for differential problems as a limit of a sequence of dynamic ones.

We compare some topologies studied in the literature and point out a kind of convergence, namely Kuratowski convergence, of time scales which is applicable and most useful for the study of continuous dependence of solutions for dynamic equations on time scales. It forms an approximation for the differential equations by dynamic equations and allows us to extend the difference approach in numerical algorithms. Finally, we study some Cauchy problems without uniqueness of solutions, which are approximated by simple dynamic problems.

Key words and phrases: time scale, dynamic equation, approximation of solutions

Integrability on Regular Time-Scales

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We investigate the notion of integrability by discussing in several different definitions. We present the integrability on time scales in the light of Gelfand-Dikii and R-matrix approach. Finally as an ongoing project, we present Kadomtsev-Petviashvili hierarchy on time scales which leads to analyze Sato theory and its applications.

Existence of Solitary Waves for Some Boussinesq-Type Equations

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We consider integrable differential-difference systems of exponential type. The integrability is understood as existence of so called $x-$ and $n-$ integrals. It is conjectured that such systems can be constructed from the integrable differential systems of exponential type. We discuss the existence of $n-$ integral for differential-difference systems constructed from integrable differential systems.

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