Naza Tanavic-Miller
Professor, Department of Mathematics, University of Sarajevo, Bosnia

Integrability and L^1 Convergence Classes on General Vilenkin Groups

Tuesday, September 7, Room 204, 2 p.m.

Abstract. Summarizing recent results on integrability and L^1 convergence classes for trigonometric system we consider the corresponding classes for the general Vilenkin systems.

Ava Warren
Hamilton County School's Math Coordinator.

Standards Under Fire: Issues and Options in the Math Wars

Thursday, September 30, Room 204, 2 p.m.

Abstract. The author is discussing changes in the approach to teaching math in the public schools.

Colloquium 1999-2000

Diane Miller, Director of the UTC Grants & Research Office

Funding Opportunities for Mathematics Research and Education

Thursday, November 4, 2:30 p.m. Metro 207

The speaker will present an overview of several grant programs that UTC faculty might want to consider to support their research and service work.

Maria Derrick, Grants Consultant in the UTC Grants Office, also will be joining Diane Miller in the presentation.

Comments. We have to change our standard Colloquium time (3:00 pm) because Diane Miller has a meeting at 3:30 or so.

C

olloquium 1999-2000

Maeve McCarthy, Murray State University

Recovery of a Density from the Eigenvalues of a Nonhomogeneous Membrane

Thursday, November 11, 2:00 p.m. Metro 207

ABSTRACT

The vibrating elastic membrane is a classical problem in Mathematical Physics which arises in a wide variety of physical applications. Since the geometry of the membrane is usually well defined for a particular problem, determination of the nature of any nonhomogeneity is critical. The eigenvalues of particular membranes are often quite accessible experimentally and so a method for the determination of the nonhomogeneity based on the available eigenvalues is of practical importance.

Projection of the boundary value problem and its coefficients onto appropriate vector spaces leads to a matrix inverse problem. Although the matrix inverse problem is of nonstandard form, it can be solved by a fixed-point iterative method. Convergence of the method for a rectangular membrane is discussed and numerical evidence of the success of the method is presented. The existence of multiple eigenvalues for certain rectangular membranes causes the analysis to fail. However, the algorithm has been adapted with some success.

http://www.math.murraystate.edu/mccarthy/

Colloquium 1999-2000

Michael Y. Li, Mississippi State University

Mathematical Analysis of the Global Dynamics of an Epidemic Model

Friday, November 5, 2:30 p.m. Metro 207

ABSTRACT

A mathematical model for the spread of an infectious disease in a host population is considered and analyzed. The model takes into account of a varying total population size and incorporates disease fatality and latency. The model results in a system of three nonlinear differential equations. The global dynamics are established using a collection of tools from the theory of differential equations, including some classical and well-known methods and the most recent techniques. Some background of epidemic modeling will also be briefly discussed.

Colloquium 1999-2000

Ed Rozema, UTC

The Mathematics Department PREREQ Data Base

Thursday, November 18, 1:45 p.m. Metro 207

ABSTRACT

The PREREQ Data Base contains Mathematics placement test scores and levels as well as grades in all UTC Mathematics courses since 1983. I will give an overview of the structure and content of the PREREQ data base, discuss accessing the data base, and point out its strengths and weaknesses. We will also discuss possible future enhancements.

Comment. We have to change our standard time because Ed has a Faculty Council Meeting at 3:00 on Nov. 18.

Colloquium 1999-2000

Professor Lutai Guan, Zhongshan University, China

Bivariate Local Basis Polynomial Natural Spline Interpolation for Scattered Data

Tuesday, November 30, 2:50 p.m. Metro 207

ABSTRACT

Since 1980's, the interpolation problem about scattered data in a plane has been a difficulty and important problem in numerical approximation and other fields. Many results were finished on this title. Here, we only discuss one kind of the solving methods,which is called polynomial natural spline interpolation.Based on the theory of spline function in Hilbert spaces, bivariate polynomial natural splines for interpolating, smoothing or general interpolating of scattered data over an arbitrary domain were constructed by the one-side function. However, this method is not well suited for large scale numerical applications. Recently, a new local support basis of the bivariate polynomial spline space is constructed. Some properties of this basis are also discussed.Methods to order scattered data are shown and algorithms for bivariate polynomial natural spline interpolation are constructed.The interpolating matrices are sparse, and thus, the algorithms can be easily implemented in a computer. To scattered data in some lines, and refinement grid points interpolating, we also give the simpler local support basis, and then discuss.

Colloquium 1999-2000

Akintoye Oloko,

graduate student, College of Engineering, UTC

Classification of a Seven Feature Data Set

Thursday, December 2, 2:30 p.m. Metro 207

ABSTRACT

Two sets of data from two sensors are given. One sensor has four features, the other have three. The first set of data will be called the training set. It contains a classification feature that tells which class a feature belongs to. The data is classified into four classes were the first class is considered dangerous and the other three safe. This problem can be treated as a two-class problem, but for academic reasons the problem will be treated as a four-class problem.

Assuming a Gaussian distribution a probability density function is generated for each class and then summed to generate a probability function for our entire sample space. This can be done if we assume that our classes are disjoint and cover the entire sample space. Using Bayesian decision theory the *a posterior* probability of the class given the pattern is then calculated. This is then used to generate a loss function for each class. The class with the minimum loss function is then chosen as the class the feature belongs to.

Accepting a decision gives rise to a classification error or correct decision both on the class and the entire space. These values are then used to see how well the features classify the data.

Colloquium 1999-2000

Boris P. Belinskiy and Peter Caithamer * , UTC

Energy of a String Driven by Gaussian Noise White in Time

Friday, January 14, 2:00 p.m. Metro 207

ABSTRACT

This talk will consider the randomly driven vibrating string and will include an introduction to white noise. We will give conditions on the driving noise both necessary and sufficient for the string to have finite energy and calculate this energy. We will show that these same conditions guarantee that the energy of the string is continuous. Finally, we will discuss generalizations of these results to the beam equation, and to general undamped mechanical systems.

* The speaker

Colloquium 1999-2000

Betsy Darken, UTC

Why Johnny Can't Do Math: Clues to an American Dilemma

Thursday, January 20, 2:00 p.m. Metro 207

ABSTRACT

True or False?

1. On a recent international test of students from dozens of industrialized countries, twelfth grade American students performed near the bottom.
2. In the same study, the top 5 % of American students scored about average compared to their peers in other countries.
3. In a recent comparison of American and Japanese mathematics classes, 89 % of the American classes were ranked low in mathematical content, compared to 11 % of the Japanese classes.
4. American teachers' understanding of fundamental mathematics is very weak in comparison to Chinese teachers.
5. Unlike Japanese students, American students are usually shown how to do a problem, and then spend a significant part of class practicing similar problems individually at their seats.

ALL of the above are true. Research studies show that American school teachers, on the average, have a very shallow understanding of mathematics. Studies also show that the amount of mathematics we expect our students to learn is relatively low. And finally, it is now a well documented fact that American students, by the time they graduate from high school, have learned less mathematics than comparable students in most other industrialized countries. What is wrong, and what can be done to fix this sad state of affairs? Unfortunately these turn out to be very complex problems, and there is furious disagreement over the answers. This talk will focus on research which sheds some light on the situation, including the possibility that – amazingly enough – there may be a cause-and-effect relationship among the above problems.

Colloquium 1999-2000

Dr. Walton Powers, TVA

A Mathematical Model of Energy Storage

Thursday, February 03, 3:00 p.m. Metro 207

ABSTRACT

In the utility industry, an interesting and important problem is the energy storage problem. Energy storage devices (such as the Raccoon Mountain pump storage facility) take in energy when the value or price of electricity is low and store it until the value or price is high. Recently I developed a simple economic model of a new "flow battery" storage device. The objective of this model is to determine the most economical size for the storage device and to quantify its value to TVA. The problem may be viewed as an application of finite mathematics - perhaps as an assignment problem. I will describe the technology, formulate a mathematical model of the problem and describe my approximate solution.

In addition, I will share some information about what other mathematicians do at TVA and the prospects for employment with the agency

Colloquium 1999-2000

Christopher Mawata and Robert Wynegar, UTC

Putting Mathematics on the Web

Using MathML and Java Servlets

Thursday, February 10, 3:00 p.m. Metro 207

ABSTRACT

A distinguishing feature of mathematics that has permeated through the sciences is the use of a complex and highly evolved system of two-dimensional symbolic notations to express ideas. Of course, the mathematics and the notation that represents it are not the same thing. The ideas exist independently of the notations.

The MathML (Mathematical Markup Language) specification of the W3C (w.w.w. Consortium) addresses the challenge of encoding both the presentation of mathematics and the content of the mathematical idea or object that the notation represents. It is designed to meet the diverse needs of the scientific community.

We shall discuss the basic principles at work in a network application that is being developed in the Mathematics Department at UTC to serve tests to students, grade them, record the grades in spreadsheet form, and give instant feedback to the students. The tests are not multiple choice and so grading them is more challenging than it would be with multiple choice questions. The application uses HTML, MathML, Javascript, and Java servlets. The talk is aimed at a general audience.

Colloquium 1999-2000

Richard C. Le Borne,

Department of Mathematics

Technical University Hamburg-Harburg, Germany

A Degree of Change for Universities in Germany

Friday, February 25, 2:00 p.m. Metro 207

ABSTRACT

Recently, German universities competed to host a new bachelor and master degree program that is taylored after the namesake programs of the U.S. and the U.K. Their current university degrees are non-overlapping with the traditional bachelors and masters degree. One reason for these additions is straightforward; Germany aspires to attract a larger student base from outside its borders. Accomplishing this goal implies change and the U.S. and U.K. served as useful models since they both have programs that are considered attractive on an international level. The bachelors degree program was mostly modeled from the U.K. when considering the sharper curriculum focus typically experienced by a student from his/her first semester.

The Technical University of Hamburg-Harburg is one such university offering these new degrees. This talk will provide an overview of the bachelor and master degree programs and then focus on the mathematics courses. Finally, some comparisons will be given between the systems found in the U.S. and Germany.

Colloquium 1999-2000

Liancheng Wang*, Mississippi State University

Global Dynamics of an SEIR Model with Vertical Transmission

Friday, March 3, 2:30 p.m. Metro 207

ABSTRACT

We study a population model for an infectious disease that speads in the host population through both horizontal and vertical transmission. The total population is assumed to be constant and the incidence term is of the standard incidence form. We prove hat the global dynamics is completely determined by a threshold parameter σ. If $\sigma \leq 1$, the disease-free equilibrium is globally stable and the disease always dies out. If $\sigma > 1$, a unique endemic equilibrium exists and is globally stable in the interior of the feasible region and the disease persists at the endemic equlibrium state if it initially exists.

*A candidate for a position at the Math Department

Colloquium 1999-2000

C. Maeve McCarthy*, Murray State University

Rearrangement Techniques in the Optimal Design of Vibrating Elastic Bodies

Monday, March 6, 2:30 p.m. Metro 207

ABSTRACT

A variety of optimal design problems in study of vibrating elastic objects can be formulated as extremal eigenvalue problems. In particular, given a fixed volume of material of known elastic properties, the optimal design of the tallest column under self-weight can be sought. Since the spectrum of the associated Sturm-Liouville problem may not be discrete, the design class must be chosen with care. In the case of circular and annular cross-sections, rearrangement techniques are used to establish the existence of optimal designs.

*A candidate for a position at the Math Department

Colloquium 1999-2000

Linda Eroh*, Western Michigan University

Rainbow Ramsey Numbers

Friday, March 10, 2:30 p.m. Metro 207

ABSTRACT

By a graph, we mean a finite set of objects, called vertices, along with a collect of two-element subsets of the vertex set, called edges. The complete graph K_n is the graph with n vertices and every possible edge. The traditional ramsey number r(m,n) is the smallest integer N such that every possible coloring of the edges of K_N with two colors, say red and blue, contains either a red K_m or a blue K_n. A popular generalization involves replacing K_m and K_n with arbitrary graphs. Expanding on a recent definition by Bialostocki and Voxman, we define the rainbow ramsey number $RR(G1, G2)$ of two graphs $G1$ and $G2$ to be the smallest positive integer N such that every possible edge-coloring of K_N with ANY number of colors must contain either a copy of $G1$ with every edge the same color or a copy of $G2$ with every edge a different color. In this talk, we will consider the existence of this number, general bounds on its value, formulas for particular classes of graphs, and a related generalization of the ramsey number.

*A candidate for a position at the Math Department

Colloquium 1999-2000

David Penniston*, Pennsylvania State University

Ramanujan, partitions and modular forms

Monday, March 13, 9:30 a.m. Metro 207

ABSTRACT

A partition of a positive integer n is a nonincreasing sequence of positive integers whose sum is n. Two functions of great interest in number theory are the classical partition function $p(n)$, which is the total number of partitions of n, and $Q(n)$, the number of partitions of n into distinct parts (for example, $3 = 2 + 1 = 1 + 1 + 1$, so $p(3) = 3$ and $Q(3) = 2$). The great Indian mathematician Ramanujan proved the remarkable result that for any nonnegative integer n, $p(5n + 4)$ is a multiple of 5, $p(7n + 5)$ is a multiple of 7, and $p(11n + 6)$ is a multiple of 11. He also conjectured other such divisibilities by higher powers of 5, 7 and 11, which were settled by Atkin and Watson, and Gordon and Hughes proved that similar results hold for $Q(n)$. Still, much has remained mysterious about these functions; for example, given an arbitrary prime number q, do there exist positive integers m and n such that $p(m)$ and $Q(n)$ are divisible by q ?

In this talk we discuss recent progress toward a fuller understanding of these partition functions, and their connection with modular forms.

*A candidate for a position at the Math Department

Colloquium 1999-2000

John Kenelly*, Clemson University

When Machines do Math, then What do Math Teachers Teach?: The Collegiate Consideration

Tuesday, March 28, 3 p.m. Fletcher 114

ABSTRACT

The lecture will be of special interest to students and faculty from various disciplines. Professor Kenelly is a world class expert in the use of technology in the teaching process.

The UTC Speakers and Special Events Committee and the Visiting Lecturers Program of the Mathematical Association of America supported this lecture series.

*John Kenelly is the Alumni Distinguished Professor of Mathematical Sciences (Emeritus) at Clemson University, South Carolina. He is best known for his work in national testing programs and the use of technology in mathematics instruction. For the College Board, he has been (interim) National Director of the Advanced Placement (AP) Program, Chair of their Academic Council, Calculus Test Development Committee, Director of the AP Readings and Chief Reader for AP Calculus. He was involved at different times in design groups for the Sharp 9200, the Hewlett Packard HP48GX, the Texas Instrument TI-83, the Casio 9850+ graphing calculators, and Casio's Algebra Tutor calculator. These interests combined when he directed the two million-dollar National Science Foundation Grants: "Teaching Mathematics with Calculators" and "Technology Intensive Calculus for Advanced Placement (TICAP)".

Colloquium 1999-2000

John Kenelly*, Clemson University

When Machines do Math, then What do Math Teachers Teach?: The Teacher Preparation Consideration

Wednesday, March 29, 4 p.m. Fletcher 113

ABSTRACT

The lecture is designed for students and faculty especially those interested in the preparation of future mathematics and science teachers for secondary and post-secondary schools.

*John Kenelly is the Alumni Distinguished Professor of Mathematical Sciences (Emeritus) at Clemson University, South Carolina. He is best known for his work in national testing programs and the use of technology in mathematics instruction. For the College Board, he has been (interim) National Director of the Advanced Placement (AP) Program, Chair of their Academic Council, Calculus Test Development Committee, Director of the AP Readings and Chief Reader for AP Calculus. He was involved at different times in design groups for the Sharp 9200, the Hewlett Packard HP48GX, the Texas Instrument TI-83, the Casio 9850+ graphing calculators, and Casio's Algebra Tutor calculator. These interests combined when he directed the two million-dollar National Science Foundation Grants: "Teaching Mathematics with Calculators" and "Technology Intensive Calculus for Advanced Placement (TICAP)".

The UTC Speakers and Special Events Committee and the Visiting Lecturers Program of the Mathematical Association of America supported this lecture series.

Colloquium 1999-2000

Allan J. Rossman, Dickinson College, Carlisle, PA

"Workshop Statistics" Active Learning, Data, and Concepts

Thursday, March 30, 2:30 p.m. Metro 207

ABSTRACT

This presentation will describe the "Workshop Statistics" approach to teaching introductory statistics. Distinguishing features of this project are emphases on active learning, conceptual understanding, genuine data, and use of technology. Hands-on activities that illustrate the pedagogical approach and curricular materials will be presented, and implementation suggestions will also be offered.

Biographical sketch:

Allan Rossman is a professor of Statistics at Dickinson College. He is the primary author of "Workshop Statistics", published by Springer-Verlag, an innovative series of text/workbooks consisting of activities that lead students to discover and explore fundamental ideas of introductory statistics for themselves. He has directed the MAA's NSF-funded STATS (Statistical Thinking with Active Teaching Strategies) project, which conducted a series of workshops for mathematicians who teach statistics. Dr. Rossman is currently chair of the ASA/MAA Joint Committee on Undergraduate Statistics and chair-elect of the Statistical Education section of the ASA. He serves on the editorial board of the *Journal of Statistics Education* and writes the "Outlier...s" column of STATS magazine.

Colloquium 1999-2000

John W. Neuberger*, University of North Texas

Differential Equations: Computing and the Real World

Friday, April 14, 2 p.m., Fletcher 114

ABSTRACT

The lecture will be of special interest to students and faculty from the Departments of Mathematics and Physics, and College of Engineering. Professor Neuberger is a world class expert in Applied Mathematics.

*John W. Neuberger is the Regent Professor at the University of North Texas. He taught at some of the best departments of Mathematics in the world including the Institute for Advanced Study, Princeton, Cambridge University, and the Weizman Institute; he has supervised about thirty Ph.D. degrees in mathematics. He has worked for different teaching and research centers, including the Military Research Laboratory, Institute for Air Weapons Research, Institute for Defense Analysis, Oak Ridge National Laboratory, National Security Agency, etc.

The UTC Speakers and Special Events Committee and the Visiting Lecturers Program of the Mathematical Association of America supported this lecture series

Colloquium 1999-2000

John W. Neubergwer*, University of North Texas

What Do Mathematicians Do?

Monday, April 17, 3 p.m., Fletcher 114

ABSTRACT

Designed for students, faculty and the general public, this lecture describes what mathematicians do and the importance of mathematics in various areas of study.

*John W. Neuberger is the Regent Professor at the University of North Texas. He taught at some of the best departments of Mathematics in the world including the Institute for Advanced Study, Princeton, Cambridge University, and the Weizman Institute; he has supervised about thirty Ph.D. degrees in mathematics. He has worked for different teaching and research centers, including the Military Research Laboratory, Institute for Air Weapons Research, Institute for Defense Analysis, Oak Ridge National Laboratory, National Security Agency, etc.

The UTC Speakers and Special Events Committee and the Visiting Lecturers Program of the Mathematical Association of America supported this lecture series

Colloquium 1999-2000

Charles R. Johnson, College of William & Mary, VA

Graphs, Eigenvalues, and Multiplicities

Thursday, April 20, 3:30 p.m. Metro 207

ABSTRACT

We report on ongoing work on the inverse eigenvalue problem for Hermitian matrices via study of the possible lists of multiplicities of eigenvalues (in order corresponding to the numerical values of the eigenvalues) among Hermitian matrices with a given graph. The case of trees is already quite challenging and provides some remarkable surprises.

Colloquium 1999-2000

Chuanxi Qian, Mississippi State University

On Asymptotic Behavior of Third-order Nonlinear Differential Equations

Monday, May 15, 2:00 p.m. Metro 300

ABSTRACT

In this talk, we will present some globally asymptotic stability results for the following third-order nonlinear differential equation $x''' + \psi(x, x')x'' + f(x, x') = 0$ $(*)$ and some of its special cases. We also discuss the boundedness and convergence of solutions of Eq.(*) with a perturbation term $p(t)$ on the right side.

Colloquium 1999-2000

Bo Zhang, Fayetteville State University

Construction of Liapunov Functions for Systems of Linear Ordinary and Delay Differential Equations

Tuesday, May 16, 2:00 p.m. Metro 300

ABSTRACT

Explicit quadratic Liapunov functions and functionals which provide necessary and sufficient conditions for the asymptotic stability of the system of linear ordinary differential equations $\dot{x} = Ax(t)$ and delay differential equations $\dot{x} = Ax(t-r)$ are constructed by using a set of determinantal identities to transform the original systems to $\dot{y} = Gy(t)$ and $\dot{y} = Gy(t-r)$, respectively, where G is a companion matrix associated with the characteristic polynomial of A. The applications of these determinantal identities to the system of difference equations $x(t+1) = Ax(t)$ and other dynamical systems are also discussed.

Colloquium 1999-2000

Boris S. Pavlov, University of Auckland, New Zealand

Spectral Analysis of Physical Networks

Monday, May 22, 2:30 p.m. Metro 300

ABSTRACT

Modern interest to the spectral analysis of Schrödinger operator on physical networks is motivated by necessity of quantum logical devices, which serve to manipulate quantum current. For devices constructed as networks of quantum wires on the interface of an electrolyte and a narrow-gap semiconductor the length of De-Broghlie wave is usually much greater than the width of the wires, so that the wires become quasi-one-dimensional in proper scale and the one-electron Hamiltonians of the networks may be represented by Schrödinger operators on hybrid domains or compact graphs with few one-dimensional branches attached to them by special boundary conditions. These hybrid Schrödinger operators possess new interesting spectral features, in particular they exhibit the property of resonance conductance which permits manipulating the corresponding quantum current via the external classical electric field or by another quantum current in frames of relevant few-body spectral problem. The problem of calculating the conductance is reduced to the mathematical problem of investigation of analytic properties and asymptotic behavior of the corresponding multi-channel scattering matrices for one-body or few-body scattering problem for hybrid Schrödinger Operators. In particular we show that the phenomenon of the resonance conductance in the network constructed of a compact subgraph or domain with few one-dimensional quantum wires attached to it is defined by the configuration of zeroes and/or zero-lines of the resonance eigenfunction on the compact part of the system, which corresponds to the resonance eigenvalue (equal to the Fermi-level in the wires). For instance when considering a hybrid Schrödinger Operator on a domain with few quasi-one-dimensional quantum wires attached to it via tunneling across the potential barrier high $\ln \frac{1}{\beta}$ (above the Fermi level in the wires) the next statement is true:

Theorem*If* $\varphi_0(a_s)$ *are the values of the normalized resonance eigenfunction at the points of contact, then the transmission (reflection) coefficient* S_{st} *from one wire to another for the weakening connection* $\beta \to 0$ *has at the simple resonance eigenvalue* λ_0 *the form:* $S_{st}(\lambda) = -\delta_{st} - 2ikO(\beta^2) + (I + ikO(\beta^2))\frac{2k\beta^2}{k\beta^2 \sum_s |\varphi_0(a_s)|^2 + i(\lambda_0 - \lambda)}\varphi_0(a_s)\varphi_0(a_t) + O(|\beta|^4).\}$

Colloquium 1999-2000

János Karsai, Department of Medical Informatics, Faculty of Medicine,
University of Szeged, Hungary
e-mail: karsai@silver.szote.u-szeged.hu

Mathematica Applications for Education and Research at the Department of Medical Informatics, University of Szeged

Thursday, May 25, 3:30 p.m. Metro 300

ABSTRACT

Since the appearance of high powered computing tools with realistic graphical capabilities, computer visualization and simulation has become an organic part of scientific research and education, and now, it is a new discipline in itself. Visualization techniques are widely used in almost every field of scientific research, even in abstract disciplines such as mathematics. Such tools help to understand and illustrate the problems from different branches of applied and pure mathematics. On the other hand, the visualization methods are based on deep mathematical theories; the phenomena in applied fields can be described by quite complicated mathematical models, and so the influence of mathematics and the computer-aided mathematical modeling methods are still increasing. Realizing this fact, several years ago we started to use computer visualization tools in the Mathematics lectures for Pharmacy students, and introduced the undergraduate/graduate course "Computer-aided mathematical modeling". This latter course is directed towards students in medicine, pharmacy, biology, chemistry and the life sciences in general. In our talk, we speak about our methods, applications, experiences, and we present some Mathematica projects used in our classes. In this talk, we do not speak about formal calculations, such as integration, equation solving and matrix manipulations. Their applicability is evident. Rather, on the examples of our teaching and research we show some of those Mathematica packages and applications that help our experiments to investigate these systems. Among the others, we show packages to solve impulsive systems with fixed impulse instants and several functions to visualize 2D and 3D flows.

The UTC Speakers and Special Events Committee supported this lecture.

Colloquium 1999-2000

János Karsai, Department of Medical Informatics, Faculty of Medicine,
University of Szeged, Hungary
e-mail: karsai@silver.szote.u-szeged.hu

Impulse Effects in Nonlinear Differential Equations

Thursday??, May ??, 3:30 p.m. Metro 207

ABSTRACT

Systems with impulse effects are important models of several physical and biological phenomena. Some impulse effects are analogous to continuously distributed ones, but because of their instantaneous nature, impulses can result in new unexpected properties. First, with the help of simple examples, such as the model of ball–beating and the repeated drug dosage we sketch some basic problems arising with impulsive systems. Then, we derive the nonlinear second order impulsive system

$$\ddot{x} + f(x) = 0, \quad (t \neq t_n); \;\; \dot{x}(t_n + 0) = b_n \dot{x}(t_n), \qquad (t_n \nearrow \infty, \text{ as } n \to \infty) \tag{1}$$

with $0 \leq b_n \leq 1$ being a model of an instantaneously perturbed oscillator from the equation of the nonlinear damped oscillator

$$\ddot{x} + g(t)\dot{x} + f(x) = 0 \quad (g(t) \geq 0).$$

We will see that if $b_n < 0$, the impulses describe a "beating" effect that cannot be modeled by just a differential equation. Moreover, with a little modification of the system (1) we obtain systems describing some relaxation oscillations.

MATHEMATICS DEPARTMENT COLLOQUIUM SERIES

COLLOQUIUM Fall 1999

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Professor, Department of Mathematics, University of Sarajevo, Bosnia, former UTC faculty
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Tuesday, September 7, Room 204, 2 p.m.

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COLLOQUIUM Spring 2000

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Department of Medical Informatics, Faculty of Medicine, University of Szeged, Hungary
Mathematica Applications for Education and Research at the Department of Medical Informatics, University of Szeged
Thursday, May 25, 3:30 p.m. Metro 300