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Fall 2007

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**Abstracts of the Colloquium Talks: Fall 2007**  
**Department of Mathematics**

<b>Date</b>	<b>Speaker and Title</b>
Thursday, Aug 30	Youssef Raffoul, University of Dayton Basic and Recent Results in Differential Equations
Thursday, Sep 6	Youssef Raffoul, University of Dayton Introduction to Time Scales with Applications to Neutral Nonlinear Dynamic Equations
Thursday, Sep 13	Muhammad Islam, University of Dayton Liapunov's method to study L-p properties of Volterra integral equations
Thursday, Sep 20	Art Busch, University of Dayton Arc-traceable Local Tournaments
Thursday, Sep 27	Ruihua Liu, University of Dayton The Valuation of Guaranteed Equity-Linked Life Insurance with Option of Early Surrender
Thursday, Oct 4	Maher B. Qumsiyeh, Bethlehem University/University of Dayton Edgeworth Expansions and the Bootstrap
Thursday, Oct 18	Maher B. Qumsiyeh, Bethlehem University/University of Dayton Bootstrapping and Empirical Edgeworth Expansions In Multiple Regression Models
Thursday, Oct 25	Art Busch, University of Dayton
Thursday, Nov 8	Jo Hoffacker, Clemson University The Southern Pine Beetle: an Introduction with Preliminary Time Scale Model
Thursday, Nov 15	Thomas C. Gard, Professor Emeritus, University of Georgia Introduction to Stochastic Population Dynamics
Thursday, Nov 29	Adam Parker, Wittenberg University A Birational Model for the Moduli Space of Stable Maps
Thursday, Dec 6	Nickolai Kosmatov, University of Arkansas - Little Rock Nonlinear initial and boundary value problems of fractional order

**Basic and Recent Results in Neutral Differential Equations**  
Youssef N. Raffoul

**Abstract:** The authors Zhixiang Li, Xiao Wang of the paper

[1] *Existence of positive periodic solutions for neutral functional differential equations*, Electron. J. Diff. Eqns., Vol. 2006(2006), No. 34, pp. 1-8

attempted to prove the existence of positive periodic solutions of the nonlinear neutral differential equation

$$d \, dt[x(t) - ax(t - \tau)] = r(t)x(t) - f(t, x(t - \tau))$$

by using cone theory. It was pointed out that the results in the paper are not correct since the two sets  $\Omega_1$  and  $\Omega_2$  that were constructed by the authors are not open in the Banach space. For the same reason, an addendum has been added to the paper.

The main aim of this research is to give a correct proof for the existence of a positive periodic solution by using a different fixed point theorem from the one used in [1]

### **Introduction to Time Scales with Applications to Neutral Nonlinear Dynamic Equations**

Youssef N. Raffou

**Abstract:** The study of dynamic equations on time scales is a new and fast growing branch of mathematics. Introduced by Stephan Hilger in 1989, time scales unify and extend continuous and discrete calculi. Differential equations, difference equations and qdifference equations are examples of dynamic equations on time scales. One of the main uses of time scales is to study hybrid systems, systems that exhibit both continuous and discrete behavior. We will present some basic concepts of time scales including  $\Delta$ -derivatives, properties of the exponential function, the chain rule, and the substitution rule for  $\Delta$ -integrals. We will also define periodic time scales and give examples. As an application, we show the existence of periodic solutions of the neutral dynamic equation with delay on a time scale

$$x \Delta(t) = -a(t)x \sigma(t) + c(t)x \Delta(t - k) + q(t, x(t), x(t - k)), t \in T,$$

Under a slightly more stringent inequality we show that the periodic solution is unique

### **Liapunov's method to study $L - p$ properties of Volterra integral equations**

Muhammad Islam

**Abstract** Liapunov's direct method has been a popular technique to study various qualitative properties of ordinary and functional differential equations. The use of this method in integral equations however is very limited. In this research Liapunov's method is used to study various  $L - p$  properties of solutions of certain nonlinear integral equations of Volterra type.

### **Arc-traceable Local Tournaments**

Arthur Busch

**Abstract** A directed graph  $D$  is arc-traceable if every arc is on some hamiltonian path of  $D$ . A directed graph is a local tournament if it has girth at least three and the in-neighborhood and out-neighborhood of every vertex induces a tournament (i.e. an oriented complete graph). In this talk we characterize arc-traceable local tournaments.

### **The Valuation of Guaranteed Equity-Linked Life Insurance with Option of Early Surrender**

R. H. Liu

**Abstract** In this work we study the valuation of equity-linked life insurance with guaranteed minimum benefits and with the option of early surrender. These guarantees are embedded options of American type and unlike stock options, whose prices are paid up front, are paid via a continuous deduction of the investment value until the termination of contract. We value the contracts under a regime-switching diffusion model for the equity-fund price and a regime-dependent interest rate. We formulate the valuation as an optimal stopping problem and derive an analytical solution for a special two-dimensional case.

Key Words. Equity-linked life Insurance, regime-switching, early surrender, American option.

### **Edgeworth Expansions and The Bootstrap**

Maher B. Qumsiyeh

**Abstract** This is the first part of a two part series regarding Edgeworth Expansions and the Bootstrap. This first part is primarily a basic introduction to teach the participants about the background, definitions, and basic theory of Edgeworth Expansions. The following basic techniques will be presented: Edgeworth (Asymptotic) Expansion, Empirical Edgeworth Expansion, and the Bootstrap. These methods will be evaluated on how well they approximate the sampling distribution. Finally, the methods will be compared against each other with regards to performance with standardized and well as studentized means. I will also answer questions regarding both methods. The second part of the series will be held at a later date and will address advanced topics such as Edgeworth Expansions and the Bootstrap in Regression models.

### **Bootstrapping and Empirical Edgeworth Expansions In Multiple Regression Models**

Maher B. Qumsiyeh

**Abstract** A general asymptotic expansion for the distribution of the studentized least squares in multiple linear regression models is obtained without assuming normal errors and under simple easily verifiable conditions. These expansions provide a better than the normal approximation for estimation and testing. It is also shown that the bootstrap approximation for the distribution of the studentized least squares estimate has a valid asymptotic expansion and this shows that the bootstrap is better than the normal for approximating the distribution of the studentized least squares estimate. A comparison between the bootstrap approximation and the empirical Edgeworth expansion is also provided showing that the bootstrap approximation for the distribution of the studentized least squares estimate is better than the two-term Edgeworth expansion. Expansions for the weighted least square are mentioned. Possible future work on asymptotic expansions and the bootstrap will be discussed.

### **Introduction to Stochastic Population Dynamics**

Thomas C. Gard

**Abstract:** Density dependent percapita growth rates can lead to stability and complex behavior in population dynamics and interaction models. Modeling uncertainty in such models, as well as in an increasing number of other applications, leads to stochastic differential equations. The notion of an equilibrium for such models corresponds to a stationary distribution. In this talk, a brief introduction to SDEs in the context of population dynamics is presented. That density dependent random fluctuations in the per capita growth rate can result in a positive stationary distribution is illustrated by an example.