

Farrah Jackson Chandler

University of North Carolina Wilmington

On the Classification of k -involutions of $SP(n,k)$

www.uncw.edu/math/faculty/about-faculty-chandler.html

chandlerf@uncw.edu

Symmetric spaces defined over a field k of characteristic not equal to 2 are completely characterized by the k -involution of the corresponding reductive group. A first characterization of the isomorphism classes of k -involutions for reductive algebraic groups defined over a field k of characteristic not 2 was given by Helminck in 2000 using 3 invariants. Two of these 3 invariants are difficult to classify.

In this talk we consider the group $SP(n, k)$ and give a different and much more detailed characterization of the isomorphism classes of k -involutions for this group. For this we first show that each involution of $SP(n, k)$ is the restriction of an involution of $SL(n,k)$. Next we determine which involutions of $SL(n,k)$ remain involutions when restricted to $SP(n,k)$. To complete the classification for a specific base field it remains to determine in how many $SP(2n,k)$ -isomorphism classes one $SL(n,k)$ -isomorphism class of such a k -involution of $SL(n,k)$ splits.



Ethelbert N. Chukwu

North Carolina State University

Going for Growth: A Mathematical Economic Perspective

www4.ncsu.edu/~chukwu

In this paper, models of Gross Domestic Product and Employment of two interacting nations are derived. It is a hereditary differential game of pursuit. It utilizes the principles of supply and demand and of rational expectation. A theory of interaction via net export is postulated. The net export function may include trade, debt repayment, etc. International employment can also be included. The UN and IMF data for two nations are used to validate the theory and test for the degree of cooperation and competition. MATLAB and Maple programs are exploited. The consequences of cooperation and competition are studied, and controllability questions answered. Once the system is proved controllable it can be made sufficiently cooperating, and sustained growth of GDP and employment can be guaranteed.



Dominic Clemence

North Carolina Agricultural and Technical State University

***User-Friendly Numerical Integration of Dynamical Systems: An HIV
Pathogenesis Model***
clemence@ncat.edu

Models used to study the dynamics of diseases often take the form of nonlinear dynamical systems, whose integration requires considerable expertise. However, such models are increasingly used in applications by non-numerical specialists, and simple methods for their integration are thus desirable. In this note, a model for the cellular interaction dynamics of the human immunodeficiency virus (HIV) is considered as an example. The model consists of a first order nonlinear dynamical system of five equations, with class variables for native CD4 T-lymphocytes, infected CD4 T-lymphocytes, native CD8 T-lymphocytes, activated T-lymphocytes, and HIV virions. A model created using the dynamic programming software Stella to integrate the considered system is discussed. While the software is user-friendly and easy to use for non-specialists, incorrect results can easily be obtained due to nonlinear integration limitations of the numerical methods on which Stella is built. The model may consequently be incorrectly interpreted by the numerically inexperienced user, leading to errors in biomedical conclusions derived from it. A nonstandard finite difference scheme and its simple implementation is given and discussed as an alternative to overcome these limitations.



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Gelonia Dent
North Carolina Agricultural and Technical State University
(TBA)
dentlg@gmail.com



Jeffrey Forbes
Duke University
Modeling and Analysis of Social Networks
www.cs.duke.edu/~forbes
forbes@cs.duke.edu

The study of social networks has a long academic history. Analytic techniques initially developed by sociologists, psychologists, and anthropologists have evolved into exploratory techniques, modeling and simulation software, and statistical methods for analyzing networks. Networks in general and social networks in particular are now studied by physicists, statisticians, and computer scientists. At Duke, we are proposing and developing a new approach to computer science by studying topics that arise from social networks and modeling as an alternative to the traditional programming approach. This new approach is intended to attract the interest of a broader population than those currently interested in computing fields. This talk will demonstrate some of the techniques for modeling networks with power law distributions and analyzing their properties using graphical models.



Charles Hagwood
National Institute of Standards and Technology
Dynamics of DNA in and Around a Nanopore
hagwood@nist.gov

Single stranded DNA is modeled as a flexible polymer. The motion of such DNA in a vessel partitioned by a membrane containing a cylindrical nanopore is modeled. Statistical quantities such as the probability that a polymer end is at the pore entrance at time t , first passage time to the pore entrance, and the translocation time through the pore are all derived. These quantities are useful for understanding the mechanism of DNA transport through the pore.



Rudy Horne

Florida State University

Solitary Waves in Discrete Media and Four-Wave Mixing Products

www.math.fsu.edu/People/faculty.php?id=641

horne@math.fsu.edu

In this talk, I will discuss solutions that arise in a vector discrete model of the nonlinear Schrödinger equation where nonlinear inter-component coupling and four-wave mixing are taken into account. We show that the solutions to this model give rise to two single-mode branch solutions as well as two mixed-mode branch solutions. These solutions are obtained explicitly and their stability is analyzed in the so-called anti-continuum limit. Also, we connect this analysis to recent experiments that motivated this work.



Johnny Houston (Banquet Keynote Speaker)

Elizabeth City State University

Mathematics is Global and Africa is an Integral Part of the Globe

jlhouston@mail.ecsu.edu

This presentation has four distinct parts. First, it addresses the global community of scholars in the mathematical sciences and the presenter's active involvement with this community. Secondly, the presenter discusses Africa as a unique continent, a land of many cultures. Thirdly, the presenter discusses his involvement with the mathematical science community in Africa. Finally, the presenter discusses the current major project for which he is providing leadership: Program Director of Elizabeth City State University's *Textbooks and Learning Materials Program* (TLMP). We are writing textbooks and learning materials for sub-Saharan Africa; especially the West African country of Senegal.



Otis Jennings

Duke University

***Nurse-to-Patient Ratios and Bed Capacity in Hospitals:
A Queueing Perspective***

www.fuqua.duke.edu/faculty/alpha/jennings.htm

otisj@duke.edu

The health care industry is plagued by rising costs, inefficient and strained resources, inequity in care provision, and shortages in expert staff. Policymakers continue to struggle with effective measures to address these issues. Unsurprisingly, their attempts at resource allocation are contentious at best. For instance, Trenton, NJ currently has roughly three times as many hospital beds per capita than the New Jersey average. Further, the number of residents in the city is steadily declining. Plans to close one of the city's less used hospitals and replace it with one in a fast-growing (and ostensibly more profitable) suburb are under consideration -- to the chagrin of many residents.

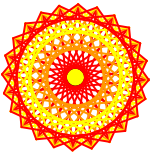
California, as well, passed a law in 1999, Bill AB394, mandating nurse-to-patient staffing ratios as a means to guarantee uniform quality of service among hospitals across the state. The actual ratios were set and went into effect in 2004 after extensive debates among nurse unions and hospital administrators. Even now, compliance to the ratios remains a political sticking point.

In this talk we consider the hospital bed and nurse staffing questions jointly. Bed availability is altered on a monthly or yearly timescale, while workforce schedules are made on daily or weekly basis. Both of these, together, are capacity management decisions and can be evaluated in terms of quality of service as experienced by patients. A reasonable quality measure tracks the timely provision of service, whether in assigning a bed to a new patient or in dispatching a nurse to a patient in need. We evaluate capacity management decisions using a queueing theoretic approach to modeling and analyzing hospital operations. We conclude that nurse-to-patient ratios is no staffing panacea, high bed utilization leads to extensive delays, and staffing decisions can adversely affect bed availability.



Arlie Petters
Duke University
Gravity, Light, and Mathematics
www.math.duke.edu/~petters
petters@math.duke.edu

Shadow patterns are all around us. We drive through them on the way to work and swim among them in pools. Similar patterns are also cast throughout the universe by the gravitational fields of stars and galaxies. We unveil some of the cosmic and mathematical secrets of these mysterious and beautiful patterns, and show how they can be used to test theories of gravity.



Kimberly Weems

North Carolina State University

***An Instrumental Variable Approach to Estimation in
Logistic Regression Measurement Error Models***

www4.stat.ncsu.edu/~weems

weems@stat.ncsu.edu

Scientists often have to determine disease patterns using noisy or indirect measurements as covariates. It is not possible to perform a direct statistical analysis of the dependence of a response, such as the presence of absence of a disease, on the covariate measured with error. We consider parameter estimation in logistic regression models with measurement error using an instrumental variable approach. The conditional-scores method of Stefanski and Carroll (1987) is used. We obtain sufficient statistics for the unobserved predictors and the conditional distribution of the observed data given these sufficient statistics. Unbiased score functions that are free of the unknown predictors are then used to derive unbiased estimating equations for the model parameters. This work generalizes that of Buzas and Stefanski (1996) to non-normal instrumental variables. Simulation results and an application to real data are presented to illustrate this method.