Archived Seminars
2006/07

September 27, 2006: Andrey Babichevi (CSUF)

Title: *Nonstandard analysis. Is it so naive?*

Abstract: I anticipate that many people who will come today did not make it to my previous talks on the subject. So I will try to make this talk independent and self-sufficient, but cover some new stuff as well. I would also like to engage the audience in the discussion about the topic. (I think we had very nice discussions before).

October 4, 2006: Travis Kelm (CSUF)

Title: *Car Crashes and Algebraic Topology*

Abstract: The computation of the second homotopy group (π_2) of a two- dimensional CW complex is rather more complicated than the computation of the first homotopy group. Certain labelled oriented graphs on the sphere are quite relevant in the computation of π_2. As a result interesting properties of such graphs can be exploited. One quaint property, discovered by Anton A. Klyachko, involves the crashing of cars driving on the graph, and was used to settle an outstanding problem in the theory of equations over groups. The speaker hopes to introduce Klyachkos Car Crash Lemma and discuss applications.

October 11, 2006: Doreen De Leon (CSUF)

Title: *Introduction to Multigrid Methods II*

Abstract: This is a continuation of the previous talk. It was called (you guessed it!) ”Introduction to Multigrid Methods I” and had the following abstract: Multigrid methods are used to more efficiently solve partial differential equations. Discretization of partial differential equations results in a linear system of equations whose coefficient matrix is sparse. Such systems can be solved using iterative methods. Although iterative methods initially reduce the error rapidly, after a few iterations the speed of error reduction slows down significantly. Multigrid methods are designed to compensate for this problem. In this talk, I plan to discuss some background material and introduce the idea of multigrid methods.

October 18, 2006: Andrey Babichev (CSUF)

Title: *First Steps in Dynamics on the Real Line: What happens if you iterate $f(x) = 4x(1 - x)$ or similar functions?*

Abstract: Iterations of simple functions like the one mentioned above show surprisingly rich behavior. We will try to analyze it using elementary methods.

October 25, 2006: Aaron Reite

Title: *Sperner's Lemma, Brouwer's Fixed Point Theorem, Birthday Cakes, and Roommates*

Abstract: This talk will concern applications of Sperner's Lemma - a rather simple combinatorial result regarding triangulations of simplices. Most notably we will give an elementary proof of Brouwer's Fixed Point Theorem using Sperner's Lemma (and no algebraic topology!) We will then briefly discuss some applications of Sperner's Lemma to fair division.

November 2, 2006: Slava Archava (CSUF)

Title: *Algebraic Cycles and Hodge Theory*

Abstract: The study of algebraic cycles begins with the classical theorem of Abel which answers the following question: given a collection of points p_i on a Riemann surface S and integers n_i when does there exist a meromorphic function on S with poles/zeroes of multiplicity n_i at p_i's? I would like to explain this theorem as well as more recent results. The subject is abound with beautiful results as well as many open questions (Hodge conjecture, one of the Clay Institute's Millennium problems, is a famous example) and brave conjectures. I will try to make the talk accessible and self-contained.

November 8, 2006: Doreen De Leon (CSUF)

Title: *Introduction to Multigrid Methods III*

Abstract: In this installment of the Introduction to Multigrid Methods series, we will discuss the main ingredients for multigrid methods, namely intergrid transfer operators (to move between the coarse and fine grids) and the coarse grid operator (representing the underlying differential equation on coarser grids). We will then put these ingredients together and make some standard multigrid methods. If time allows, a numerical example will be demonstrated.

November 16, 2006: Slava Archava (CSUF)

Title: *Algebraic Cycles and Hodge Theory II*

Abstract: In this installment (to borrow Doreens becoming terminology) of the series, I will prove the general form of the Abel's theorem and discuss its generalizations to higher dimensional varieties.

November 30, 2006: Peter Tannenbaum (CSUF)

Title: *On Permanents*

Abstract: The permanent of a square matrix is just like the determinant, but different (Yogi Berra said it!) The burning issue behind my talk is: are permanents here to stay, or just a passing fancy? Come and find out. The outline of my talk:

1. Definitions

December 6, 2006: Larry Cusick (CSUF)

Title: *The Hyperoctahedral Group & Free Symmetries of the Hypercube*

Abstract: The hyperoctahedral group B_n is the group of symmetries of the n-dimensional hypercube. A free symmetry is an element of B_n that does not fix any vertex of the cube. Well mine free symmetries for surprises.

February 1, 2007: Vladimir Dzhunushaliev (Professor of Physics, Kyrgyz-Russian Slavic University, Bishkek, Kyrgyz Republic)

Title: *Nonassociativity in Physics*

Abstract: One of the most important problems in modern physics is the problem of quantization of strongly interacting fields (quantum chromodynamics, gravity). The problem is connected with the fact that the algebra of quantum fields operators is still unknown. In the talk the possibility of building of an algebras of quantum field operators on the basis of a nonassociative algebra is considered. To do this the generalization of octonions numbers to a nonassociative algebra is considered. The associators for the product of three operators is offered. The self-consistency of such defenition is considered. The physical applications of the proposed algebra is discussed. The open questions are listed.

February 8, 2007: Andrey Babichev (CSUF)

Title: *Quaternions and Rotations of* $\mathbb{R}^3$

Abstract: Can one make sense of $1 + (0,0,1)$ or $1/(-2,3,5)$? What is the result of the rotation of $\mathbb{R}^3$ on 180 degrees counterclockwise around $i + j + k$, and then on the same angle around i? Answers to these and other interesting questions is provided by quaternions, the one and only noncommutative associative division algebra over $\mathbb{R}$, discovered by the Irish mathematician Sir William Rowan Hamilton in 1843. Quaternions and the nonassociative extension of quaternions, known as octonions, found some applications in physics and appeared in a couple of talks in this seminar before. We will consider the definition, basic properties and some applications of quaternions.

February 15, 2007: Vladimir Dzhunushaliev (Professor of Physics, Kyrgyz-Russian Slavic University, Bishkek, Kyrgyz Republic)

Title: *Observables and Unobservables in a Non-Associative Quantum Theory*

Abstract: In the talk it will be shown that (1) in a non-associative quantum theory the non-associative operators are unobservables; (b)the observables quantity may be presented only by the elements of an associative subalgebra; (c) the elements of the associative subalgebra are extended objects which can be similar to strings; (d) the field equations can be written for a non-assocaitive quantum theory.

March 22, 2007: Maria Nogin (CSUF)

Title: *The Logic of Topology*

Abstract: In this talk we will see how the language of mathematical logic can express properties of topological spaces and dynamic topological systems. This is a modern research area that arose out of the need to design reliable hybrid control systems such as airplane autopilots. Classical and recent results (one of them is joint work of the speaker and Aleksey Nogin) and open questions will be discussed. Bring your tea/coffee, candies will be provided.