Real time explicit guidance utilizing analytical extremal trajectory and attitude solutions

Dilmurat Azimov
University of Hawaii at Manoa, azimov@hawaii.edu

The objective is to design automatic and guidance and targeting laws for a real-time implementation on board of aerospace systems to autonomously perform thrusting maneuvers utilizing analytical synthesis of optimal control solutions. Explicit analytical synthesis of extremal and/or optimal trajectories will enable quick and reliable surveys of behaviors of the design parameters. Design of extremal maneuvers can serve as nominal- reference solutions in the design of autonomous guidance laws. Up to date, no explicitly integrated and accurate guidance and targeting schemes for a real-time implementation have been reported.

The presentation will discuss the resent research results on low- and high- thrust trajectory design and guidance schemes with applications to low Earth orbital transfers, powered descent and landing maneuvers, and asteroid rendezvous. New estimation techniques, such as constrained admissible region - multiple hypothesis filter utilizing mixture of experts, are also highlighted as part of a complete real-time guidance system synthesis.

A Coopetitive-dynamical game model for currency markets stabilization

David Carfi
University of Messina, davidcarfi@gmail.com

The aim of this paper is to propose a dynamical methodology to stabilize the currency markets and at same time to address indirectly the Credit Crunch phenomenon. We adopt Game Theory and specifically the new mathematical model of Coopetitive Game proposed in literature by D. Carf‘? and some its associated dynamical aspect. Our idea is to save the Euro from speculative attacks by the introduction of a currency transactions tax. Specif- ically, we focus on a real economic operator - Ferrari S.p.A., our first player - and on an investment bank - Unicredit, our second player. The unique solution that allows both play- ers to win something, and therefore the only one collectively desirable, is represented by an agreement between the two subjects about the division of the maximum collective gain. We propose also a possible division of gains (even more advantageous than the previous one) in a coopetitive context, where the two above economic subjects use a loan by the ECB to obtain a greater win. keywords. Currency Markets; Financial Risk; Financial Crisis; Game Theory; Speculation; Coopetition MSC. 91A80; 91A35; 91B26; 90B50 JEL. C70, D53, F00, G01, G21, M20.

From odometers to rotations

Matthew Foreman
University of California Irvine, mforeman@math.uci.edu

An ergodic measure preserving transformation is odometer based if its Kronecker factor is an odometer map. It is circular if its Kronecker factor is an irrational rotation. This talk presents a canonical functor from odometer based to circular systems and proves that the resulting circular systems can all be realized as ergodic measure preserving transformations of the disk or the torus. The work is joint with B. Weiss.

Quadratic stochastic operators and evolutionary dynamics of zero-sum games

Nasir Ganikhodjaev
International Islamic University Malaysia, gnasir@iium.edu.my

During the last decades within game theory, evolutionary and dynamical aspects have exploded. A two-player symmetric game consists of a finite set of strategies indexed by $I = \{1, 2, \ldots, n\}$ and an $n \times n$ payoff matrix (a_{ij}). In evolutionary game dynamics we imagine a large population of game players, each with a fixed strategy. The evolutionary dynamics of discrete zero-sum games is described by Volterra quadratic stochastic operators.

In this talk we discuss a trajectory behavior of Volterra quadratic stochastic operators and the evolutionary dynamics of discrete zero-sum games respectively. We prove that non-ergodic Volterra quadratic stochastic operator describes a paper-rock-scissers game.

On Sums of Dynamically Defined Cantor Sets

Anton Gorodetski
University of California Irvine, asgor@math.uci.edu

Palis' Conjecture on sums of Cantor sets claims that typically a sum of two dynamically defined Cantor sets either has zero measure or contains an interval. In 2001 Moreira and Yoccoz proved that generically a sum of two dynamically defined Cantor sets with sums of Hausdorff dimensions larger than one contains an interval, therefore confirming Palis' Conjecture for generic nonlinear Cantor sets. The genericity assumptions there do not allow to apply the result to a specific one- or finite- dimensional family of Cantor sets, which is the setting encountered in many applications. In particular, Palis' Conjecture for affine Cantor sets is still open.

Based on the recent results on convolutions of singular measures (joint with D.Damanik and B.Solomyak), we show that generically (for almost all values of parameters) the sum of two affine Cantor sets has positive Lebesgue measure provided the sum of their Hausdorff dimensions is greater than one (this is a joint result with S.Northrup). Moreover, in the current work in progress (joint with D.Damanik and Y.Takahashi) we show that the sum of a fixed compact set and a Cantor set from a one-parameter family also has positive Lebesgue measure for almost all parameters under the assumption that the Hausdorff dimension of the Cantor set changes monotonically with the parameter (once again, provided the

sum of Hausdorff dimensions of the compact set and the Cantor set is greater than one). Some applications of the these results to spectral theory will be provided.

Dynamical systems in Hilbert spaces and their applications

Gafurjan Ibragimov
Universiti Putra Malaysia and National University of Uzbekistan,
ibragimov@upm.edu.my

First, we discuss the reduction of control systems described by parabolic and hyperbolic differential equations to some infinite systems of ordinary differential equations by using the decomposition method. Hence, there is a significant relationship between the control problems described by partial differential equations and those described by infinite systems of differential equations. The latter are of independent interest and can be investigated within one theoretical framework. Thus, we have arrived at dynamical systems described by infinite system of differential equations in some Hilbert spaces.

Second, we discuss existence and uniqueness theorems for an infinite system of differential equations in Hilbert space. Such systems are now considered independently of partial differential equations. We define the set of control functions and space of solutions. The existence and uniqueness theorems will be formulated for some infinite systems.

Further, we formulate differential game problems for infinite system of differential equations and discuss some solved and unsolved game problems.

The "Markov partition or local flows" alternative in one-dimensional (pseudo)group actions

Victor Kleptsyn
Institut de Recherche Mathématique de Rennes, CNRS, victor.kleptsyn@univ-rennes1.fr

My talk will be devoted to a recent progress in the understanding of (pseudo)group actions on the circle (as well as foliations of real codimension one).

One large class of such actions is those that are sufficiently rich: there are local flows in local closure. Roughly speaking, restricting the dynamics on some subinterval J and closing it in $C^1(J)$, one finds a one-parameter subgroup generated by some vector field (to be more precise, a neighborhood of identity in such subgroup: the flow is no longer defined once the points leave J). In this case, it is easy to obtain the Lebesgue-ergodicity of the action as a corollary of the one of such local flow (and there are some other interesting conclusions).

Another large class consists of the actions admitting a Markov partition. The presence of such a partition is quite restrictive, giving us a good control on the action. An example of such action is the standard action of $PSL(2,\mathbb{Z})$ or (in the non-minimal case) the Schottky group.

Recent results, obtained in a joint project with B. Deroin, D. Filimonov, A. Navas suggest (though do not establish in its full generality) that there is nothing else but these two classes. In other words, the following alternative seems to hold: an action either admits a Markov partition, or has local flows in its local closure.

Non-commutative Wiener-Wintner Theorem

Semyon Litvinov
Pennsylvania State University Hazleton, snl2@psu.edu

For a von Neumann algebra M with a faithful normal tracial state τ and a positive ergodic homomorpsism $\alpha : L^1(M,\tau) \to L^1(M,\tau)$ such that τ does not increase the norm in M and $\tau \circ \alpha = \tau$, we establish a non-commutative counterpart of the classical Wiener-Wintner ergodic theorem.

Patterns of oscillation in a generalized rivalry network

Tyler McMillen
California State University Fullerton, tmcmillen@exchange.fullerton.edu

Multistable perception, wherein physically invariant stimulation leads to oscillations in perception, has been studied for over 100 years. Examples include perceptual rivalry when viewing the Necker cube, and binocular rivalry where two dissimilar images are presented to the eyes.

In this talk I will present a model for generalized rivalry where two or more patterns in a network can oscillate in periods of dominance. In the case of two patterns, I will show how the network can be reduced to a three cell network, and that the dynamics of the reduced network are organized by a Takens-Bogdanov singularity. I will briefly discuss the problem when there are more than two patterns, in which case there are several open problems that may of interest to those working in dynamical systems.

On the Statistical Properties of Direct Product Systems

Marks Ruziboev
ICTP/SISSA, mruziboe@sissa.it

We consider direct product of finitely many Young towers with the tails decaying at certain rate and show that the product map admits a Young tower whose tail can be estimated in terms of the rates of component towers. It has been shown that many systems admit such a towers and our results therefore imply statistical properties such as decay of correlations, central limit theorem, large deviations, local limit theorem for large class of product systems.

Lee-Yang and Fisher zeros of the Fibonacci Ising Chain

William Yessen
Rice University, yessen@rice.edu

We study the nearest neighbor Ising model in one dimension immersed in a transverse magnetic field. The nearest neighbor interactions and/or the magnetic field follow the Fibonacci substitution sequence (which is a good model for a one-dimensional quasicrystal). Existence of an explicit renormalization map, which turns out to be a polynomial Axiom A diffeomorphism acting on algebraic surfaces, makes it possible to study the Lee-Yang and Fisher zeros as a problem in hyperbolic

dynamics. We shall describe the history of the problem, the dynamical techniques, and state some important results (on the distribution of the Lee-Yang-Fisher zeros).