INFORMATION ON MASTER'THESIS

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7. Official thesis title:

"Dynamics of Komogorov systems of competitive type under the telegraph noise"

8. Major:
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11. Summary of the finding of the thesis:

This paper studies the dynamics of Kolmogorov systems of competitive type under the telegraph noise. The telegraph noise switches at random two Kolmogorov competition-type deterministic models. The aim of this work is to describe the omega-limit set of the system and investigates properties of stationary density.

For eco-systems consisting of two species, many mathematical models in biology science and population ecology frequently involve the systems of ordinary differential equations having the form

Where x and y represent the population density and f(x,y), g(x,y) are the capita growth rate of each species. Usually, such systems are calle d Kolmogorov systems. Kolmogorov type systems are the most general models for situations in which per capita growth rate of each species depends on the population sizes of both species. It is an important topic that whether every orbit starting in the interior of the first quadrant of the phase plane (i.e.x(0)>0, y(0)>0) remains persistent for system (1). There have been numerous works investigating the dynamics of the positive solutions such as the uniformly strong persistence, the extinction and ultimately boundedness.

In these models, it is assumed that species live in a constant environment. Therefore, the capita growth rates f(x,y) and g(x,y) are deterministic functions. However, it is clear that it is not the case in reality and that it is important to take into account the variability of the environment which may have important consequences on the dynamics and persistence of the community. The variability of the environment may be expressed under the random factors. Meanwhile the deterministic Kolmogorov system (1) has been studied for a long history, for the random Kolmogorov systems, there is not too much in mathematical literature, and almost nothing in statistical inference. Here, we mention one of the first attempts in this direction, the very interesting paper of Arnold et al. in which the authors used the theory of Brownian motion processes and the related white noise models to study the sample paths of the equation. For the branching models in a varying environment. A systematic review has been given in [1]. Recently, [16] considers the influence of both Markov switching and white noise on system (1.1); A. Bobrowski et al. in [8] use the Markov semigroup to study the stability of the stationary distribution of random systems (1.1); W. Shen, Y. Wang in [19] study the random competitive Kolmogorov systems via the skew-product flows approach...

In the simplest case, one might consider that environmental conditions can switch randomly between two states, for instance: hot state and cold one, dry state and wet one.... Thus, we can suppose there is a telegraph noise affecting on the model in the form of switching between two-element set, $E = \{+,-\}$. With different states, the dynamics of model are different. The stochastic displacement of environmental conditions provokes model to change from the system in state + to the system in state – and vice versa.

In [7], authors have studied the classical competitive systems with telegraph noise. It is shown that the ω-limit set of the solutions for those systems are very complicated. Some subsets of the ω-limit set have been pointed out. The purpose of this paper is to generalize these results by considering a generalized systems and by describing completely all ω-limit sets of the solutions. We also prove that the ω-limit set of every positive solution is the same and it absorbs all positive solution. More-over, we want to go further by investigating some properties of the stationary distribution. We show that the stationary distribution (if it exists) has the density and it attracts all other distribution. Although we are unable to give an explicit formula for the threshold values λ_1, λ_2 we can easily estimate them. This factor plays an important role in practice because by analyzing the coefficients, we understand the behavior of the systems.

The rest paper is organized as follows: In Section 2 we describe pathwise dynamic behavior of the positive solutions for the competitive type systems under the effect of telegraph noise. It is shown that the ω-limit set absorbs all positive solutions. The Section 3 concerns with the stability of the stationary density by using the Foguel alternative theorem in [17]. The last section gives an application to the classical competitive model.

This thesis is divided into three chapters,

Chapter 1: The preparation knowledge.

The content of this chapter is to give the competition of Kolmogorov all system models and the properties of the continuous-time Markov process, finite state Markov process.

Chapter 2: The asymptotic properties of Kolmogorov systems of competitive under the telegraph noise.

In this chapter, the thesis will clarify the results achieved are described orbital dynamics of the positive test for the competitive system under the impact of the telegraph noise. It shows that the set Ω-limit absorb all positive. This chapter also offers three specific cases of posture of the number of solutions of the Kolmogorov system under Markov noise.

Chapter 3: Application to model the classical equations competition.

In this chapter, the essay will describe the posture of the number of solutions of the classical equations competitive Lotka-Volterra in 3 specific case.

Date: 01/12/2012

Signature:

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