Nasir Ganikhodjaev
Farrukh Mukhamedov
Pah Chin Hee

VOLUME 1

$x' = 2xy$

$y' = 2xz$

INVESTIGATIONS ON PURE MATHEMATICS, FINANCE MATHEMATICS AND OPTICS

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$\varphi_1(x, y, z) = z$

$\pi_1 = \begin{pmatrix} x & y & z \\ y & z & x \end{pmatrix}$

$x' = x^2 + y^2 + z^2 + 2yz$

$\pi_1 V_1 \pi_1 = V_{17}$

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Investigations on Pure Mathematics, Finance Mathematics and Optics

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THE BEHAVIOR OF TRAJECTORY OF ξ^s QUADRATIC STOCHASTIC OPERATIONS

Afifah Hanum Mohd Jamal
Assoc. Prof. Dr. Farrukh Mukhamedov

Abstract. *This thesis studies the* ξ^S *Quadratic Stochastic Operators (QSO) defined on 1-D simplex and on 2-D simplex. We prove that the trajectory of* ξ^S*-QSO on l-D simplex convergent with respect to its Cesaro mean. Next, we introduce six non conjugating classes for* ξ^S*-QSO on 2-D simplex. Moreover, we prove convergence of trajectories of some classes and study their certain properties.*

1 Quadratic Stochastic Operators

According to Bernstein (1924) and Voltera (1927). Lotka-Volterra (LV) systems are usually used to represent the time evolution of differing species in biology. LV systems have been widely studied by Lotka (1920) and Volterra (1931). According to Takeuchi (1996), many other natural phenomena are being modelled by LV systems. Alternatively, the employment of LV discrete-time systems is a recognized subject of applied mathematics (Lyubich, 1992). Moran (1950) first introduced LV systems in a biomathematical framework which were later developed by May and Oster (1976). Since then. the investigation of dynamical properties and modelling in various fields running from economy (Dohtani. 1992) to population dynamics (Fisher, 1977), and from physics (Udwadia, 1998) to mathematics (Hofbauer 1998; Lyubich. 1992 Takeuchi, 1996; Ulam, 1960) have been using LV systems to be the source of analysis. in all these applications. the LV systems are commonly taken quadratic.

Discretization of dynamical systems has to be considered while investigating the computational aspects of such systems. This has lead to the study of the trajectory of discrete time Volterra operators. Ganikhodzhaev (2006) and Mukharnedov (2005) are among the many studies that have considered and investigated discrete time Volterra operators. The relationship that has been established between such dynamical systems and theory of events has provided a number of information concerning the trajectory of Volterra operators due to the relation of the corresponding events to the fixed points of Volterra operators. Although studies on some ergodic properties of such operators (in small dimensions) have been done (Ganikhodjaev, 2004; Zakharevich. 1978). much more information about the behaviour of Volterra operators is still yet to be discovered.

According to Hofbauer (1998 and Lyubich (1992), in context of biology, a quadratic stochastic operator (QSO) acts as an operator of a population evolution, which arises as follows. Consider a population composed of m species. Let $x^0 = (x_1^0, x_2^0, \dots, x_m^0)$ be the probability distribution of species in the initial generations, and $P_{i,j,k}$ be the probability that individuals in the ith and jth species interbreed or crossbreed to produce an individual k. Then the probability distribution $x' = (x_1', x_2', \dots, x_m')$ of the species in the first generation can be found by the total probability, i.e.