Nasir Ganikhodjaev
Farrukh Mukhamedov
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VOLUME 1

$$x' = 2xy$$
$$y' = 2xz$$

INVESTIGATIONS ON PURE MATHEMATICS, FINANCE MATHEMATICS AND OPTICS

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

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

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ON NONLINEAR DYNAMIC SYSTEMS ARISING IN POTTS MODEL

Ashraf Mohamed Nawi
Prof. Dr. Nasir Ganikhodjaev

Abstract. *This project paper focuses to learn about the dynamical systems of the Potts model. The main discussion here is about the behaviour of a particular attractor and the phase diagram. By providing the numerical exact phase diagrams in this manual, it will assist the reader to portray the ideas. This manual provides a full explanation of the dimension and portrays the graphs for supplementary understanding.*

1 Introduction

Statistical physics seeks to finding out how the dynamics of the microscopic components of matter such as atoms and molecules, will determine the behaviour of macroscopic objects containing a collection of atoms and molecules. This objects suppose are sensible like can be touch, see. For example, a slice of cake or a cup of tea. This is the issue of statistical mechanics which provides a mathematical structure for describing how the well-ordered higher level formations may result from random, non-directed activity of a huge number of interacting lower level beings.

Positively, the studying of many aspects of behaviour of macroscopic systems such as the changing from the ice to water can be observe from simplified models of the structure and interaction of atoms. This also included the analysis of simplified mathematical models. The Potts model (Potts, R.B. 1952), was initiated as generalization of the Ising model considering only "up" and "down" spins, then the Potts model fit in for more possibilities of spins and interactions. The Potts model describes a simply defined class of statistical mechanics models. And in the same way, it, well-off structures is amazing capable to illustrate 41 almost every possible nuance of the subject. In Wu, F.Y. (1982), there is state that the Potts model encompasses a number of problems in statistical physics.

A phase diagram of a model describes a morphology of phases, transitions from one phase to another and corresponding transitions line. A Potts model just as an Ising model on a Cayley tree with competing interactions, has recently been studied extensively because of the appearance of nontrivial magnetic orderings.

The Cayley tree is not a realistic lattice, but, it gives much more simple solution than for problem on a regular lattice. The exact calculation of a variety of measure is possible in the Cayley tree. This will lead to varies study of typical attractors of the dynamical system generated by the Potts model.

On the Cayley tree one can consider two types of next-nearest-neighbours, there are one level next-nearest-neighbours and prolonged next nearest neighbour. In this case of the Potts model, we construct the Potts model with competing nearest neighbour interactions J_1 and prolonged next-nearest-neighbour interactions J_p. It is believed that several among its interesting thermal properties could persist for regular lattices, for which the exact calculation is by far intractable. From Ganikhodjaev N. N. *et al* (1990), there was the phase diagrams of q-state Potts model on the Bethe lattices had been studied. Then, the pure phases of the ferromagnetic Potts model were found. The Bethe lattices were fruitfully used, providing a deeper insight into the behaviour of the Potts models.

Furthermore, in depth study of Potts model properties were carried out with basically exact result, using rather simple computer simulation method There are suggests that the further complicated models should be studied on the trees. In the hope, there be discovering