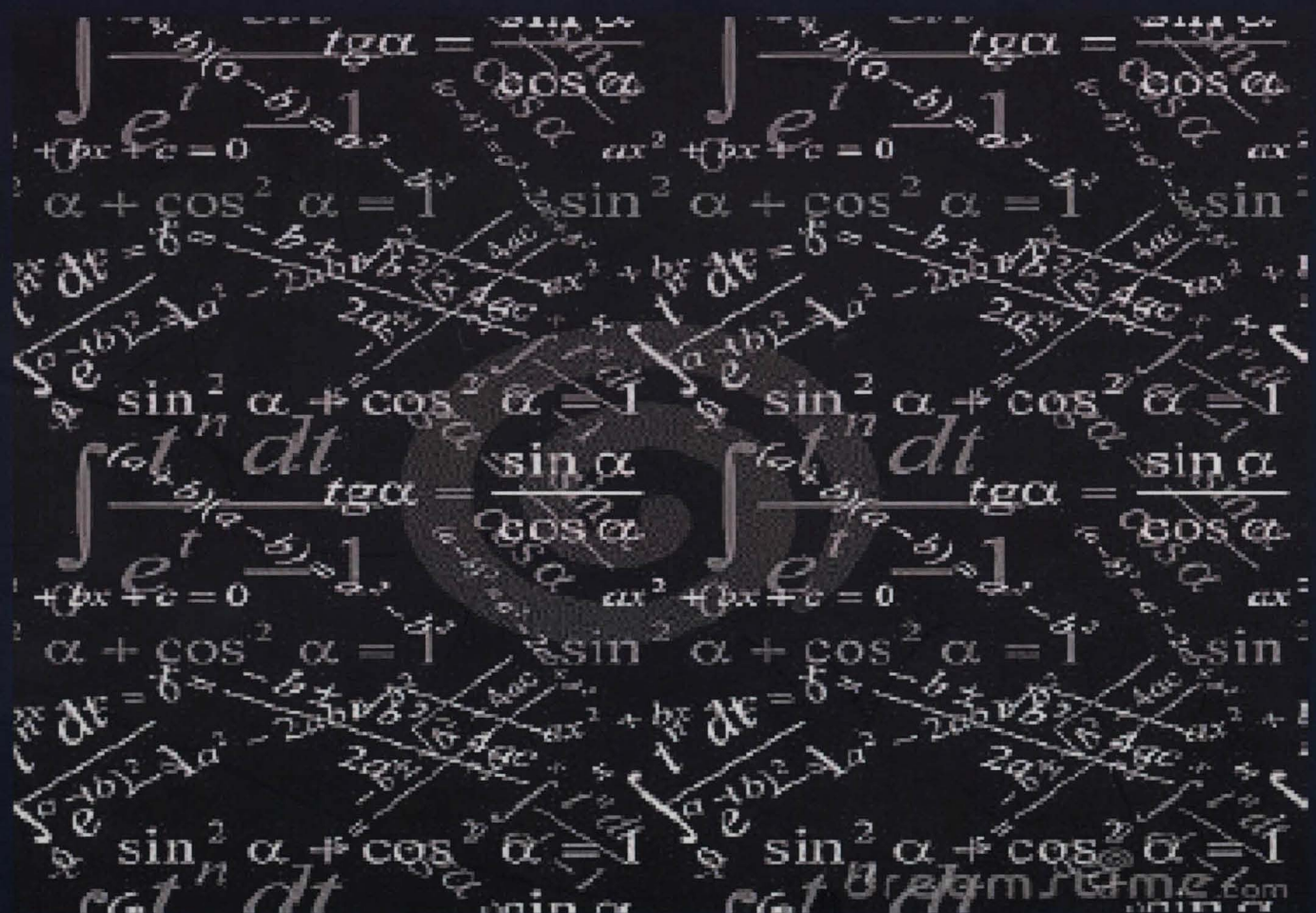




RECENT ACHIEVEMENTS IN DYNAMICAL SYSTEMS

Proceedings of Department of
Computational and Theoretical
Sciences, Faculty of Science, IIUM



Chief Editor : Farrukh Mukhamedov

Editors : Nasir Ganikhodjaev

: Mansoor Saburov

Proceedings of Department of
Computational and Theoretical Sciences,
Faculty of Science, IIUM

Recent Achievements in Dynamical Systems

Chief Editor: Farrukh Mukhamedov

Editors:
Nasir Ganikhodjaev
Mansoor Saburov

Vol. 2



IIUM Press

Published by:
IIUM Press
International Islamic University Malaysia

First Edition, 2011
©IIUM Press, IIUM

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without any prior written permission of the publisher.

Perpustakaan Negara Malaysia Cataloguing-in-Publication Data

Farrukh Mukhamedov, Nasir Ganikhodjaev & Mansoor Saburov
Recent Achievements in Dynamical Systems
Farrukh Mukhamedov, Nasir Ganikhodjaev & Mansoor Saburov

ISBN: 978-967-418-201-4

Member of Majlis Penerbitan Ilmiah Malaysia – MAPIM
(Malaysian Scholarly Publishing Council)

Printed by :
IIUM PRINTING SDN. BHD.
No. 1, Jalan Industri Batu Caves 1/3
Taman Perindustrian Batu Caves
Batu Caves Centre Point
68100 Batu Caves
Selangor Darul Ehsan

Contents

Part I. Quadratic Operators and Their Dynamics

Farrukh Mukhamedov, Abduaziz Abduganiev, Maksut Mukhamedov, On Dynamics of a Class of Quantum Quadratic Operators on $M_2(\mathbb{C})$.	2
Mansoor Saburov, On Ergodic Principle for Quadratic Volterra Operators.	9
Mansoor Saburov, Fixed Point of Compositions of Volterra Operators.	15
Farrukh Mukhamedov, Afifah Hanum Bt Mohd. Jamal, Classification of ξ^s - Quadratic Stochastic Operators in 2D-Simplex.	21
Farrukh Mukhamedov, Mansoor Saburov, Afifah Hanum Bt Mohd. Jamal, Dynamics of ξ^s - Quadratic Stochastic Operators in 2D-Simplex.	29
Farrukh Mukhamedov, Mansoor Saburov, Some Examples of Lotka- Volterra Type Models.	34
Nasir Ganikhodjaev, Makhsuma Usmanova, On Linearization of Quadratic Stochastic Operators.	40
Nasir Ganikhodjaev, Continual Family of Ergodic Non-Homogeneous Markov Chains.	47
Rasul Ganikhodjaev, Farrukh Mukhamedov, Mansoor Saburov, On G- Decomposition of Matrices.	53
Farrukh Mukhamedov, On L_1 -Weak Ergodicity of Nonhomogeneous Discrete Markov Processes	59
Inomjon Ganiev, Farrukh Mukhamedov, On Measurable Bundles of C^* -Dynamical Systems.	65
Inomjon Ganiev, Farrukh Mukhamedov, A Weighted Ergodic Theorem for Contractions Defined on Banach-Kantorovich Lattice.	71

Part II. Dynamical Systems Arising From Physical Models

Farrukh Mukhamedov, Mansoor Saburov, Dynamical Systems of XY-Models On A Cayley Tree Of Order Two.	78
Farrukh Mukhamedov, Mansoor Saburov, Dynamical Systems of XY-Models On A Cayley Tree Of Order Three.	85
Farrukh Mukhamedov, Mansoor Saburov, Dynamical Systems of Ising Model on a Cayley Tree.	91
Nasir Ganikhodjaev, Siti Fatimah Zakaria, Phase Diagram of The Ising Model with Nearest-Neighbor Interactions.	98
Nasir Ganikhodjaev, Siti Fatimah Zakaria, Ising Model on a General Cayley Tree with Competing Next-Nearest-Neighbour Interactions.	107
Pah Chin Hee, Rukiah Ali, Ising Model with Competing Interactions on Cayley Tree of Order Four	118
Massimo Ostilli, Langevin Dynamics for a New Class of Mean-Field Ising Models.	125
Farrukh Mukhamedov, Utkir Rozikov, Free Energy of The Ising Model with Competing Interactions on a Cayley Tree.	133
A. Benseghir, B.A. Umarov, A. Messikh, Modulational Instability In Salerno Model.	141
Nasir Ganikhodjaev, Seyit Temir, On Potts Model with Triple Interactions.	146
Nasir Ganikhodjaev, Ashraf Mohamed Nawi, Mohd Hirzie Mohd Rodzhan, Phase Diagram Of The Potts Model with External Magnetic Field.	152
Nasir Ganikhodjaev, Fatimah Abdul Razak, A Correlation Inequality for Potts Model.	160
Nasir Ganikhodjaev, Ashraf Mohamed Nawi, A Nonlinear Dynamic System Arising in Potts Model.	167

Farrukh Mukhamedov, On Existence of Phase Transition for One Dimensional P-Adic Countable State Potts Model.	177
B.A. Umarov, A. Bouketir, Strongly Localized Models In Two-Component Discrete Media With Cubic-Quintic Nonlinearity.	184
Part III. Nonlinear Dynamical Systems	
Farrukh Mukhamedov , Wan Nur Fairuz Alwani Wan Rozali, On P-Adic Generalized Logistic Dynamical System.	196
Farrukh Mukhamedov, Mansoor Saburov, On Equation $x^q = a$ over \mathcal{Q}_p .	201
Farrukh Mukhamedov, Mansoor Saburov, On Unification of The Strong Convergence Theorems for a Finite Family Of TAN Mappings in Banach Spaces.	207
Part IV. Graphs And Networks	
Pah Chin Hee, Single Polygon Counting for Two Fixed Nodes on a Cayley Tree of Order 2.	214
Khikmat Saburov, Mansoor Saburov, Every 3-Connected $K_{1,3}Z_6$ -Free Graph is Hamiltonian.	219
Khikmat Saburov, Mansoor Saburov, Relation Between $K_{1,3}P_7$ -Free and $K_{1,3}N_{1,1,1}$ -Free Graphs.	224
Khikmat Saburov, Mansoor Saburov, Hamiltonicity Of $K_{1,3}B_{i,7-i}$ -Free Graphs.	232
Saadi Bin Ahmad Kamtuddin , Nor Azura Md Ghani, Choong-Yeun Liong And Abdul Aziz Jemain, Artificial Neural Network Implementation on Firearm Recognition System via Ring Firing Pin Impression Image.	242
Pah Chin Hee, Dirichlet's Theorem And Prime Gap Statistics.	256

PHASE DIAGRAM OF THE ISING MODEL WITH NEAREST-NEIGHBOR INTERACTIONS

Nasir Ganikhodjaev¹ and Siti Fatimah Zakaria²

^{1,2} *Department of Computational & Theoretical Sciences,
Faculty of Science, International Islamic University Malaysia,
P.O. Box, 141, 25710, Kuantan, Pahang, Malaysia
E-mail: ¹gnasir@iiu.edu.my, ²sifazasz@gmail.com*

Abstract

We study the phase diagram of the Ising model on a Cayley tree with competing prolonged next-nearest neighbour J_p and one-level next-nearest neighbour interactions J_0 . Vannimenus proved that the phase diagram of Ising model with competing nearest-neighbour interaction J_1 and prolonged next-nearest neighbour interactions J_p contains a modulated phase, as found for similar models on periodic lattices. Later Mariz et al generalized this result for Ising model with $J_0 \neq 0$. For given lattice model on a Cayley tree, i.e., $J_p \neq 0$; $J_0 \neq 0$ with $J_1 = 0$ we describe phase diagram and clarify the role of nearest-neighbour interaction J_1 and show that the class of modulated phases consists of so-called antiphase with period 4 only

Keywords: *Lattice models, Cayley tree, prolonged next-nearest neighbour, one-level next-nearest neighbour, modulated phase*

Introduction

Variety of phenomena in magnetic systems has been observed in certain models with the existence of competing interactions. Systems exhibiting spatially modulated structures, commensurate or incommensurate with the underlying lattice, are of current interest in condensed matter physics [1]. Among the idealized systems for modulated ordering, the axial next-nearest-neighbour Ising (ANNNI) model, originally introduced by Elliot [3] to describe the sinusoidal magnetic structure of Erbium, and the chiral Potts model, introduced by Ostlund [14] and Huse [6] in connection with monolayers adsorbed on rectangular substrates, have been studied extensively by a variety of techniques. A particularly interesting and powerful method is the study of modulated phases through the measure-preserving map generated by the mean-field equations, as applied by Bak [2] and Jensen and Bak [7] to the ANNNI model. The main drawback of the method lies in the fact that thermodynamic solutions correspond to stationary but unstable orbits. However, when these models are defined on Cayley trees, as in the case of the Ising model with competing interactions examined by Vannimenus [17], it turns out that physically interesting solutions correspond to the attractors of the mapping comes to present. This simplifies the numerical work