INVESTIGATIONS ON PURE MATHEMATICS, FINANCE AND OPTICS

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Investigations on Pure Mathematics, Finance Mathematics and Optics

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Contents

Preface

Part I Pure Mathematics Concentration

Chapter 1  THE BEHAVIOR OF TRAJECTORY OF \( x \) QUADRATIC STOCHASTIC OPERATIONS  2
Chapter 2  THEORY OF MARKOV CHAINS IN PEDIATRIC DISEASES  8
Chapter 3  ON NONLINEAR DYNAMIC SYSTEMS ARISING IN POTT'S MODEL  14
Chapter 4  THE FIRST RETURN TIME AND DIMENSION  22
Chapter 5  ON ASSOCIATIVE ALGEBRAIC STRUCTURE OF GENETIC INHERITANCE  31
Chapter 6  INTERACTING PARTICLE SYSTEM  37
Chapter 7  DYNAMICS OF GENERALIZED LOGISTIC MAPS  43
Chapter 8  GEOMETRIC BROWNIAN MOTION AND CALCULATION OF OPTION PREMIUM IN BLACK SCHOLES MODEL  50
Chapter 9  ON THE ELEMENTARY CHARACTERIZATION OF PRIMES IN PRIMALITY TESTS: TWO SHORT STUDIES  57
Chapter 10  ON ASSOCIATIVE ALGEBRAIC STRUCTURE OF GENETIC INHERITANCE  64
Chapter 11  SOME APPLICATION OF ERGODIC THEORY IN NUMBER THEORY  70
Chapter 12  STUDY OF ROLES OF EXTERNAL MAGNETIC FIELD ON ISING AND POTT'S MODEL  76
Chapter 13  INVESTIGATION OF STABILITY OF FIXED POINTS OF NONLINEAR DISCRETE DYNAMICAL SYSTEMS  82
Chapter 14  MARKOV CHAINS AND ITS APPLICATION: THE INVENTORY MODEL  90
Chapter 15  PHASE TRANSITION FOR ISING MODEL WITH TWO COMPETING INTERACTION ON CAYLEY TREE OF ORDER 4  96
Chapter 16  LIMIT BEHAVIOR OF DYNAMIC SYSTEMS CORRESPONDING TO LATTICE MODELS WITH COMPETING PROLONGED AND ONE-LEVEL BINARY INTERACTIONS  101
Chapter 17  ASSOCIATIVE ALGEBRA IN GENETIC INHERITANCE  109
Chapter 18  ON \( F^* \)-QUADRATIC STOCHASTIC OPERATORS AND THEIR CLASSIFICATIONS  115
Part II Finance Mathematics Concentration

Chapter 19 ANALYZING THE PERFORMANCE OF INVESTMENT STRATEGY OF EPF 123
Chapter 20 PREDICTION OF STOCK PRICE USING NEURAL NETWORK 130
Chapter 21 COMPARISON BETWEEN CONVENTIONAL AND ISLAMIC BOND IN MALAYSIA 136
Chapter 22 STOCK PERFORMANCE ANALYSIS BETWEEN MALAYSIAN AIRLINES SYSTEM BERHAD AND AIRASIA BERHAD 144
Chapter 23 ISLAMIC PAWNBORROWING (AR-RAHNU) AS A MICRO CREDIT INSTRUMENT IN MALAYSIA 151
Chapter 24 ANALYSIS OF CRUDE PALM OIL FUTURES PRICES TRADED ON BURSA MALAYSIA 160
Chapter 25 AN EMPIRICAL STUDY ON THE EFFICIENCY OF THE TRIM AND FILL METHOD IN CORRECTING PUBLICATION BIAS IN META ANALYSIS 166
Chapter 26 PERFORMANCE ANALYSIS OF INSURANCE AND TAKAFUL INDUSTRIES IN MALAYSIA 171
Chapter 27 ANALYSIS OF DATA USING MULTILEVEL MODELLING WITH MLwiN 179
Chapter 28 FINANCIAL PERFORMANCE OF ISLAMIC BANKING AND CONVENTIONAL BANKING IN MALAYSIA 186
Chapter 29 A STUDY ON THE EFFECT OF PUBLICATION BIAS IN META ANALYSIS 194
Chapter 30 RATIO ANALYSIS: BANK ISLAM MALAYSIA BERHAD (BIMB) & MALAYAN BANKING BERHAD (MAYBANK) 201
Chapter 31 AN ANALYSIS OF MALAYSIAN UNIT TRUST FUNDS: ISLAMIC VS CONVENTIONAL 207

Part III Optics Concentration

Chapter 32 QUANTUM TRAJECTORY METHOD USING MPI PARALLEL COMPUTING 214
Chapter 33 LINEAR WAVE PROPAGATION IN SINGLE MODE OPTICAL FIBRE 220
Chapter 34 THE OPTICAL RAY TRACING TECHNIQUE IN LENS SYSTEM WITHIN AND BEYOND PARAXIAL APPROXIMATION 226
Chapter 35 WAVE PROPAGATION IN NONLINEAR AND HOMOGENEOUS MEDIA: KERR MEDIA 234
Chapter 36 MATRIX METHODS OF OPTICAL RESONATORS 240
DYNAMICS OF GENERALIZED LOGISTIC MAPS

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Abstract. This thesis is written to discuss the dynamics of generalized logistic maps. We consider such kind of logistic maps \( f(x) = x(1-x^2) \) and \( f(x) = x(1-x^2) \). The function \( f(x) = x(1-x^2) \) has a unique fixed point and it has two periodic points of period two. The fixed point is a neutral fixed point and both of the periodic points are repelling. The function \( f(x) = x(1-x^2) \) has three fixed points and it has six periodic points of period two. The behaviour of fixed points and periodic points are attracting, repelling and neutral in a certain range.

1 Function \( f(x) = x(1-\mu x^2) \)

Devoted to investigate about the function

\[
f(x) = x(1-\mu x^2), \mu > 0,
\]

We will find the fixed points, the periodic points, eventually fixed points, and the behaviour of the fixed and periodic points.

1.1 Fixed Points

First of all, we have to find the fixed points of \( f(x) = x(1-\mu x^2) \). The fixed points are given by following equation \( f(x) = x \). Hence we have

\[
x(1-\mu x^2) = x
\]

\[
x(1-\mu x^2 - 1) = 0
\]

Solving equation above we have,

\[
x = 0 \text{ or } 1-\mu x^2 - 1 = 0
\]

therefore

\[
-\mu x^2 = 0 \text{ or } x = 0
\]

So we get \( x = 0 \) as a unique fixed point of \( f(x) = x(1-\mu x^2) \).

![Graphs showing dynamics]

Figure 1.1: Fixed point when \( \mu = 0.1 \) and \( \mu = 1 \) show that the fixed point is 0.