

CONTENTS

Contents

	Page
Introduction	1
Chapter (1) Approximation of Functions	
1.1 Introduction.....	7
1.2 Polynomial Approximation.....	8
1.2.1 The Taylor Algorithm.....	9
1.3 Restrictive Taylor Algorithm (RTA).....	10
1.3.1 Numerical Examples	11
1.4 Adomian Decomposition Method (ADM)	13
Chapter (2) Restrictive Taylor's Algorithm for Solving Convection-Diffusion Equation	
2.1 Introduction.....	20
2.2 Restrictive Taylor Algorithm for Convection Diffusion Equation.....	21
2.3 Stability Analysis for the Approximate Method.....	23
2.4 Local Truncation Error Estimation and Upper Bound for the Approximate Method.....	23
2.5 Numerical Results.....	24
Chapter (3) Restrictive Taylor Algorithm for Two-Dimensions PDEs	
3.1 Introduction.....	32
3.1.1 Initial Boundary Value Problem for Two-Dimensions Parabolic PDEs.....	32
3.1.2 Two-Dimensions Convection-Diffusion Equation.....	33

3.2 Restrictive Taylor Algorithm for the Approximate Method for Two-Dimensions PDEs.....	33
3.2.1 Initial Boundary Value Problem for the Approximate Method for Parabolic Equation.....	34
3.2.2 Convection-Diffusion Equation.....	36
3.3 Stability Analysis of the Approximate Methods for Two Dimensions PDEs.....	37
3.3.1 Stability Analysis of the Approximate Method for Two-Dimensional Initial Boundary Value Problem for Parabolic PDE.....	37
3.3.2 Stability Analysis of the Approximate Method for Two-Dimensional Convection- Diffusion Equation.....	37
3.4 Local Truncation Error Estimation and Upper Bound of the Approximate Methods for two Dimensional PDEs.....	38
3.4.1 Local Truncation Error Estimation and Upper Bound of the Approximate Method for Two-Dimensional Initial Boundary Value Problem for Parabolic PDE.....	38
3.4.2 Local Truncation Error Estimation and Upper Bound for Two-Dimensional Convection Diffusion Equation.....	38
3.5 Numerical Results.....	39

Chapter (4)

Restrictive Taylor Algorithm for Solving Singularly Perturbed Initial Boundary Value Problem for Parabolic and Hyperbolic PDEs

4.1 Introduction.....	48
4.1.1 Singularly Perturbed Initial Boundary Value Problem for Parabolic PDE.....	48
4.1.2 Singularly Perturbed Initial Boundary Value Problem for Hyperbolic PDE.....	49

4.2 Restrictive Taylor Algorithm for Solving Singularly Perturbed Parabolic PDE.....	50
4.3 Restrictive Taylor Algorithm for Solving Singularly Perturbed Hyperbolic PDE.....	51
4.4 Stability Analysis for the Approximate Methods.....	52
4.4.1 Stability Analysis for the Approximate Method Solving Singularly Perturbed Parabolic PDE.....	52
4.4.2 Stability Analysis for the Approximate Method Solving Singularly Perturbed Hyperbolic PDE.....	53
4.5 Local Truncation Error Estimation and Upper Bound for the Approximate Methods.....	53
4.5.1 Local Truncation Error Estimation and Upper Bound for the Approximate Method for Singularly Perturbed Parabolic PDE.....	53
4.5.2 Local Truncation Error Estimation and Upper Bound for the Approximate Method for Singularly Perturbed Hyperbolic PDE.....	54
4.6 Numerical Results.....	54

Chapter (5)

Solitary Wave Solutions for the General KdV and IKdV Equations by Adomian Decomposition Method

5.1 Introduction.....	62
5.2 The General KdV Equation (GKdV).....	63
5.3 Solution of GKdV Equation by using ADM.....	65
5.4 The Generalized IKdV Equation.....	73
5.5 Solution of Generalized IKdV Equation by Using ADM.....	73
5.5.1 THE TEST PROBLEMS.....	74

Chapter (6)

Comparative Study Between Restrictive Taylor, Restrictive Padé Algorithms, and Adomian Decomposition Method for the Solitary Wave Solution of the General KdV Equation

6.1 Introduction.....	79
6.2 Restrictive Taylor's Algorithm for GKdV Equation	80
6.3 Restrictive Padé Algorithm for GKdV Equation	81
6.4 Numerical Examples of the GKdV Equation	82
6.4.1 The Case ($p=1$)	82
6.4.2 The Case ($p=2$)	84
6.4.3 The Case ($p=3$).....	86

Chapter (7)

On the Convergence of the Zero Local Truncation Error of the Restrictive Taylor Algorithm for Solving IBVPs for Parabolic, Hyperbolic, Convection Diffusion, and KdV Equations

7.1 Introduction.....	96
7.2 Zero Local Truncation Error LTE Finite Difference Method for The Exact Solution of IBVP for Hyperbolic Type	96
7.3 Zero LTE For RTA For Solving IBVP For Parabolic Type ...	97
7.4 Zero LTE for RTA for Solving IBVP for Hyperbolic Type ...	99
7.5 Zero LTE for RTA for Solving Convection-Diffusion Equation	101
7.6 Zero LTE for RTA for Solving KdV Equation	103
7.7 Semi-Group of Linear Operator for Solution of Problems as Sufficient Condition for Zero LTE for RTA for the Solutions of several Types of IBVPs for PDEs	108
7.8 The Advantages and Analysis of the RTA	110

Answers and Notes for Some Remarks of the Thesis	114
Future Work.....	116
Appendices	
Appendix A Conservation Laws.....	118
Appendix B Padé and Restrictive Padé Approximations	122
Appendix C Semi-Group of Linear Operator in the Real Line and the Exponential Functions	126
References.....	128
Arabic Summary	