CONTENTS

List of Tables		i
List of Figures		ii
Preface		v
Chapter 1.	Introduction	1-22
§1.1	Linear and Nonlinear PDE	1
§1.2	Fractional differential equation	2
§1.3	Fractional Calculus	3
§1.4	Special Functions	6
	• 1.4.1 Gamma function	6
	 1.4.2 Mittag-Laffler function 	6
§1.5	Popular definitions of fractional order	7
	derivatives and fractional order integrals	
	 1.5.1 Riemann-Liouville fractional derivative 	9
	■ 1.5.2 Properties of Riemann-Liouville operator	9
	 1.5.3 Caputo fractional order derivative 	9
	 1.5.4 Properties of Caputo operator 	10
	• 1.5.5 Grunwald-Latnikov definition of	10
	fractional order derivative	

§1.6	Laplace transform of fractional order	10
	derivative	
	• 1.6.1 Laplace transform of Reimann-Liouville's	11
	fractional derivative and integral	
	 1.6.2 Laplace transform of Caputo fractional derivative 	12
§1.7	Homotopy Analysis Method (HAM)	12
§1.8	Variation Iteration Method (VIM)	16
§1.9	Variable order fractional differential equations	18
§1.10	Diffusion equations	19
§1.11	Bernstein basis polynomial	21
Chapter 2.	On the solution of the nonlinear	23-45
Chapter 2.	On the solution of the nonlinear fractional diffusion-wave equation with	23-45
Chapter 2.		23-45
Chapter 2.	fractional diffusion-wave equation with	23-45
-	fractional diffusion-wave equation with Absorption: a homotopy approach	
§2.1	fractional diffusion-wave equation with Absorption: a homotopy approach Introduction Solution of the problem by homotopy	23
§2.1	fractional diffusion-wave equation with Absorption: a homotopy approach Introduction Solution of the problem by homotopy analysis method	23 31
§2.1 §2.2	fractional diffusion-wave equation with Absorption: a homotopy approach Introduction Solution of the problem by homotopy analysis method • 2.2.1 Case-I (for n=1)	23 31 34

Chapter 3.	A new approach in fractional	46-58			
	variational iteration method to solve the				
fractional order differential equations					
§3.1	Introduction	46			
§3.2	Basic definitions	50			
	• 3.2.1 Definition	50			
	• 3.2.2 Definition	50			
	■ 3.2.3 Definition	50			
	■ 3.2.4 Definition	50			
§3.3	Algorithm of the proposed method	51			
	• 3.3.1 Example	53			
	• 3.3.2 Example	55			
§3.4	Conclusion	58			
Chapter 4.	Solution of variable order fractional	59-72			
	differential equations using homotopy				
	analysis method				
§ 4.1	Introduction	59			
§ 4.2	Formula and Definition	63			
	 4.2.1 Coimbra definition of variable order fractional derivative 	63			
	 4.2.2 Samko definition of variable order integration 	63			

§ 4. 3	Solution of the Problems by HAM	64
	• 4.3.1 Example	64
	• 4.3.2 Example	66
§ 4.4	Results and discussion	68
§ 4. 5	Conclusion	72
Chapter 5.	Study of fractional order Van der Pol	73-88
	equation	
§5.1	Introduction	73
§5.2	Solution of the problem by HAM	78
§5.3	Numerical results and discussion	81
§5.4	Conclusion	89
Chapter 6.	Numerical solution of fractional order	90-103
	vibration equation using Bernstein	70 200
	polynomial	
§6.1	Introduction	90
§6.2	Bernstein polynomials and its properties	92
§6.3	Operational matrix of the derivative using	95
	Bernstein polynomial basis	
§6.4	Considered problem and its solution	96

§6.5 Numerical results and discussion	97
§6.6 Conclusion	103
Bibliography	104-120