

Table of Contents

<i>Series Editor's Preface</i>	<i>vii</i>
<i>Acknowledgments</i>	<i>xv</i>
<i>About the Typesetting of This Book</i>	<i>xvii</i>
<i>Author's Preface</i>	<i>xix</i>
Part I: A Summary of the Decomposition Method	1
Chapter 1: The Decomposition Method	1
1.1 Introduction	3
1.2 Summary of the Decomposition Method	4
1.3 Generation of the A_n Polynomials	8
1.4 The A_n for Differential Nonlinear Operators	14
1.5 Convenient Computational Forms for the A_n Polynomials	15
1.6 Calculation of the A_n Polynomials for Composite Nonlinearities	20
1.7 New Generating Schemes - the Accelerated Polynomials	26
1.8 Convergence of the A_n Polynomials	42
1.9 Euler's Transformation	48
1.9.1 Solution of a Differential Equation by Decomposition	51
1.9.2 Application of Euler Transform to Decomposition Solution	52
1.9.3 Numerical Comparison	54
1.9.4 Solution of Linearized Equation	56
1.10 On the Validity of the Decomposition Solution	61
Chapter 2: Effects of Nonlinearity and Linearization	64
2.1 Introduction	64
2.2 Effects on Simple Systems	66
2.3 Effects on Solution for the General Case	68
Chapter 3: Research on Initial and Boundary Conditions for Differential and Partial Differential Equations	80

Part II: Applications to the Equations of Physics	89
Chapter 4: The Burger's Equation	91
Chapter 5: Heat Flow and Diffusion	97
5.1 One-Dimensional Case	97
5.2 Two-Dimensional Case	100
5.3 Three-Dimensional Case	102
5.4 Some Examples	107
5.5 Heat Conduction in an Inhomogeneous Rod	111
5.6 Nonlinear Heat Conduction	114
5.7 Heat Conduction Equation with Discontinuous Coefficients	115
5.8 Nonlinear Boundary Conditions	116
5.9 Comparisons	116
5.10 Uncoupled Equations with Coupled Conditions	119
Chapter 6: Nonlinear Oscillations in Physical Systems	121
6.1 Oscillatory Motion	121
6.2 Pendulum Problem	124
6.3 The Duffing and Van der Pol Oscillators	129
Chapter 7: The KdV Equation	136
Chapter 8: The Benjamin-Ono Equation	144
Chapter 9: The Sine-Gordon Equation	146
Chapter 10: The Nonlinear Schrödinger Equation and the Generalized Schrödinger Equation	153
10.1 Nonlinear Schrödinger Equation	153
10.2 Generalized Schrödinger Equation	154
10.3 Schrödinger's Equation with a Quartic Potential	155
Chapter 11: Nonlinear Plasmas	159
Chapter 12: The Tricomi Problem	165
Chapter 13: The Initial-Value Problem for the Wave Equation	168

Chapter 14: Nonlinear Dispersive or Dissipative Waves	170
14.1 Wave Propagation in Nonlinear Media	170
14.2 Dissipative Wave Equations	174
Chapter 15: The Nonlinear Klein–Gordon Equation	176
Chapter 16: Analysis of Model Equations of Gas Dynamics	184
Chapter 17: A New Approach to the Efinger Model for a Nonlinear Quantum Theory for Gravitating Particles	187
Chapter 18: The Navier–Stokes Equations	192
Epilogue	217
<i>Index</i>	221