

CONTENTS

Acknowledgement	iv
Contents	vi
List of Figures	viii
List of Tables	x
Preface	xii
1. Introduction	1
1.1 Moving Boundary Problems	01
1.2 Historical Background	03
1.3 Some Methods	08
1.3.1 The Shifted Chebyshev Polynomials	08
1.3.2 Some Properties of Shifted Legendre Polynomials	10
1.3.3 Homotopy Analysis Method	12
2. A Moving Boundary Problem with Variable Specific Heat and Thermal Conductivity	15
2.1 Introduction	15
2.2 Solution for General Case	19
2.3 Exact Solutions	22
2.3.1 Case 1: If $m = n = 1$ and $\beta = \alpha$.	22
2.3.2 Case 2: If $m = n = 2$ and $\beta = \alpha$.	24
2.4 The Existence and Uniqueness	25
2.5 Comparisons and Discussions	27
2.6 Conclusion	31
3. Exact and Approximate Solutions for a Freezing Problem Having Varying Thermal Coefficients and Convective Boundary Condition	33
3.1 Introduction	33
3.2 Mathematical Models of the Problem	35
3.3 Solution of the Problem	37
3.3.1 Case 1: If $\alpha = \beta$ and $p = q = 1$	38
3.3.1.1 The Existence of Unique Solution	39
3.3.2 Case 2: If $\alpha \neq \beta$ and $p = q = 2$	40
3.4 Comparisons and Results	42
3.5 Conclusion	46

4. A Stefan Problem with Temperature and Time Dependent Thermal Conductivity	47
4.1 Introduction	47
4.2 Mathematical Model	49
4.3 Solution for the Problem	51
4.3.1 Case 1: Shifted Chebyshev tau Method	51
4.3.2 Case 2: Shifted Legendre Collocation Approach	53
4.4 Results and Discussion	55
4.5 Conclusion	65
5. A Phase Change Problem including Space –Dependent Latent Heat and Periodic Heat Flux	67
5.1 Introduction	67
5.2 Mathematical Formulation	68
5.3 Solution of the Problem	69
5.4 Comparisons and Discussion	72
5.5 Conclusion	76
6. Exact Solution of a Two Phase Stefan Problem including Moving Phase Change Material	77
6.1 Introduction	77
6.2 Mathematical Model of the Problem	79
6.3 Solution of the Problem	80
6.3.1 Case 1: Solution of the Problem with Dirichlet Boundary Condition	82
6.3.2 Case 2: Solution of the Problem with Convective Boundary Condition	82
6.4 Discussion	83
6.5 Conclusion	88
Bibliography	89
List of Publications	