

CONTENTS

PREFACE	7
LIST OF SYMBOLS	11
CHAPTER I. SOME EXAMPLES TO BEGIN WITH	15
Section 1. Various Notations. Linear Equations	15
Section 2. Nonlinear Equations	19
Section 3. Nonlinear Systems	24
Section 4. Further Nonlinear Problems	27
Section 5. A Free Boundary Problem. The Plate Equation	30
CHAPTER II. INTRODUCTION	33
Section 6. Second Order Equations	33
Section 7. Higher Order Equations	37
Section 8. Spaces of Continuous Functions. Solution of a Differential Equation	43
Section 9. Boundary Conditions	46
Section 10. Solution of a Boundary Value Problem	60
Section 11. On an Integral Identity	69
CHAPTER III. THE WEAK SOLUTION OF A BOUNDARY VALUE PROBLEM	73
Section 12. The Carathéodory Property and the Nemyckii Operators	73
Section 13. Sobolev Spaces	85
Section 14. Differential Operators	94
Section 15. Boundary Value Problems	101
Section 16. Various Generalizations	131
Section 17. Regularity of the Weak Solution	160
CHAPTER IV. THE VARIATIONAL METHOD	169
Section 18. First Derivative of a Functional	169
Section 19. Potentials of Boundary Value Problems	179

Section 20. The Euler Necessary Condition	179
Section 21. Second Derivative of a Functional	182
Section 22. Lagrange Conditions	184
Section 23. Convex Functionals	187
Section 24. Weak Convergence and Weak Compactness	191
Section 25. Reflexive Spaces	195
Section 26. Existence Theorems	198
Section 27. Minimal Surfaces	218
Section 28. Excursion on Numerical Methods	225
 CHAPTER V. THE TOPOLOGICAL METHOD	 239
Section 29. Existence Theorems	239
Section 30. The Brouwer and the Leray-Schauder Degree of a Mapping	248
Section 31. General Boundary Conditions for Second Order Ordinary Differential Equations	262
Section 32. Summary of Chapters IV and V. Some Additional Remarks	267
 CHAPTER VI. NONCOERCIVE PROBLEMS	 274
Section 33. Vanishing Nonlinearities. Regular Case	274
Section 34. Vanishing Nonlinearities. Singular Case	281
Section 35. Jumping Nonlinearities with Finite Jumps	290
Section 36. Jumping Nonlinearities with Infinite Jumps	299
Section 37. Rapid Nonlinearities	307
Section 38. Periodic Problems	309
 CHAPTER VII. VARIATIONAL INEQUALITIES	 312
Section 39. Formulation of the Problem	312
Section 40. More on the Definition of the Solution of a Variational Inequality ..	318
Section 41. Examples	324
Section 42. Some Special Results	338
Section 43. Existence Theorems	343
 REFERENCES	 353
 INDEX	 357