CONTENTS

CHAPTER I. Introduction: General Concepts of Singular Perturbation Theory 1 1.1. Approximations 1 1.2. Some Basic Concepts in Asymptotics 3 1.3. Regular vs. Singular Perturbations. Layer-type vs. Secular Problems 12 1.4. Domains of Validity. Overlap and Matching 21 CHAPTER II. Layer-type Problems. Ordinary Differential Equations 31 2.1. Friedrichs' Model Example and Simple Variants 31 2.2. Linear Equations with Variable Coefficients 54 2.3. Two Artificial Examples to Illustrate Techniques 70 2.4. A Simple Nonlinear Equation Exhibiting a Wide Variety of Solutions 86 2.5. Model Equation for Flow at Low Reynolds Numbers 106 2.6. A Classical Problem: Shape of the Meniscus 132 2.7. Motion Past Two Gravitational Centers 150 2.8. Relaxation Oscillations 158 2.9. Notes on Modulation Techniques: Stokes-Lindstedt, Multiple Scales, Averaging 168

xii	Contents

CHAPTER III.	
Layer-type Problems. Partial Differential Equations	174
3.1. Introduction	174
3.2. Elliptic Equations	17'
3.3. Hyperbolic Equations	19
3.4. Evolution Equations. Shocklike Phenomena	20
3.5. Examples from Fluid Dynamics	21
List of References	24

Index

249