



شبكة المعلومات الجامعية

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ





شبكة المعلومات الجامعية



شبكة المعلومات الجامعية

التوثيق الالكتروني والميكرو فيلم

جامعة عين شمس

التوثيق الالكتروني والميكرو فيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأفلام قد اعدت دون أية تغيرات



يجب أن

تحفظ هذه الأفلام بعيداً عن الغبار

في درجة حرارة من 15 – 20 مئوية ورطوبة نسبية من 20-40 %

To be kept away from dust in dry cool place of
15 – 25c and relative humidity 20-40 %



شبكة المعلومات الجامعية



بعض الوثائق الأصلية تالفة



شبكة المعلومات الجامعية



بالرسالة صفحات
لم ترد بالأصل



El-Mansoura University
Faculty of Engineering
Department of Mathematical
and Physical Sciences.

GENERALIZED QUASILINEARIZATION FOR DEGENERATE SINGULAR PERTURBATION PROBLEMS

BY

AHMED RAGAEY ABD-ELLATEEF OMAR AHMED KAMAR

*B. Sc. Power Mechanical Engineering, El-Mansoura University, 1982,
Master of Science in Engineering Mathematics, Physical Sciences Department,
El-Mansoura University, 1991.*

*Assistant Lecturer in Mathematical and Physical Sciences Department,
Faculty of Engineering, El-Mansoura University.*

A Thesis

Submitted in Partial Fulfillment for the Requirements Of the Degree of

Doctor of Philosophy

In

ENGINEERING MATHEMATICS

SUPERVISORS

Professor Dr. V. Lakshmikantham

*Professor and Head of Mathematical Sciences Department, Florida Institute of
Technology, Florida, USA.*

Professor Dr. Abd-Ellatif El-Sedeek

Professor of Engineering Mathematics, Faculty of Engineering, Cairo University.

Professor Dr. Mohamad Mosaad

Professor of Mechanical Engineering, Faculty of Engineering, El-Mansoura University.

Dr. Gamal Attia

*Associate Professor of Engineering Mathematics, Mathematical and Physical Sciences
Department, Faculty of Engineering, El-Mansoura University.*

1999

B 9.71

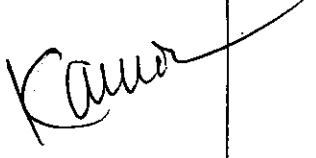
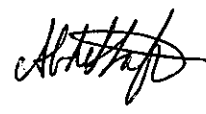

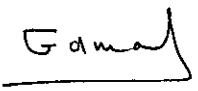
BESM ELLAH
ELRAHMAN ELRAHEEM

SUPERVISORS

**THESIS TITLE: GENERALIZED QUASILINEARIZATION FOR DEGENERATE
SINGULAR PERTURBATION PROBLEMS**

**RESEARCHER NAME: AHMED RAGAHEY ABD-ELLATEEF OMAR AHMED
KAMAR**

SUPERVISORS:

Name	Position	Signature
1. Prof. Dr. V. Lakshmikantham	Professor and Head of Mathematical Sciences Department, Florida Institute of Technology, Melbourne, Florida, USA.	
2. Prof. Dr. Abd-Ellatif El-Sedeek	Professor of Engineering Mathematics, Faculty of Engineering, Cairo University.	
3. Prof. Dr. Mohamad Mosaad	Professor of Mechanical Engineering, Faculty of Engineering, El-Mansoura University.	
4. Dr. Gamal Attia	Associate Professor of Engineering Mathematics, Faculty of Engineering, El-Mansoura University.	

To

Memory of My Father,

Memory of My Mother,

My Children, Aya, Alaa, Tasneem, Mohamad and Omar,

My Wife, and My Brother Mohamad.

Acknowledgments

All gratitude goes in the first place to **Allah** almighty who has ever guided and helped me.

After this, I wish to express my sincere appreciation and gratitude to **Prof. Dr. Lakshmikantham**, Mathematical Sciences Department, Florida Institute of Technology, Florida, USA, **Prof. Dr. Abd-Ellatiff El-Sedeek**, Engineering Mathematics Department, Cairo University, Egypt, and **Prof. Dr. Mohamad Mosaad**, Mechanical Engineering Department, Mansoura University, Egypt, for their continuous effort, guidance, careful supervision, encouragement, and support throughout this work.

Also, I thank **Dr. Gamal Attia**, Mathematical and Physical Sciences Department, Mansoura University, Egypt for his support and encouragement throughout this work.

CONTENTS

	PAGE
ACKNOWLEDGMENTS.....	i
TABLE OF CONTENTS.....	ii
CHAPTER 1 INTRODUCTION.....	1
1.1 THE METHOD OF UPPER AND LOWER SOLUTIONS.....	2
1.2 THE METHOD OF QUASILINEARIZATION.....	3
1.3 THESIS ARRANGEMENT.....	6
CHAPTER 2 MONOTONE ITERATIVE TECHNIQUE FOR DEGENERATE SINGULAR PERTURBATION PROBLEM.....	8
2.1 INTRODUCTION.....	9
2.2 MAIN RESULTS.....	12
THEOREM 2.2.1.....	12
CHAPTER 3 MONOTONE ITERATIVE TECHNIQUE FOR DEGENERATE SINGULAR PERTURBATION PROBLEM WITH PERIODIC BOUNDARY CONDITIONS.....	23
3.1 INTRODUCTION.....	24
LEMMA 3.1.1.....	25
LEMMA 3.1.2.....	25
3.2 MAIN RESULTS.....	25
THEOREM 3.2.1.....	26

CHAPTER 4 THE METHOD OF GENERALIZED QUASILINEARIZATION FOR DEGENERATE SINGULAR PERTURBATION	
PROBLEM	37
4.1 INTRODUCTION.....	38
4.2 MAIN RESULTS.....	39
THEOREM 4.2.1.....	40
CHAPTER 5 EXTENSION OF THE METHOD OF GENERALIZED QUASILINEARIZATION FOR DEGENERATE SINGULAR PERTURBATION PROBLEM	47
5.1 INTRODUCTION.....	48
5.2 MAIN RESULTS.....	49
THEOREM 5.2.1.....	49
CHAPTER 6 THE METHOD OF GENERALIZED QUASILINEARIZATION FOR DEGENERATE SINGULAR PERTURBATION PROBLEM WITH PERIODIC BOUNDARY CONDITIONS	62
6.1 INTRODUCTION.....	63
6.2 MAIN RESULTS.....	64
THEOREM 6.2.1.....	64
CHAPTER 7 GENERALIZED QUASILINEARIZATION FOR SINGULAR SYSTEM OF DIFFERENTIAL EQUATIONS	76
7.1 INTRODUCTION.....	77
7.2 PRELIMINARIES.....	77
THEOREM 7.2.1.....	77
THEOREM 7.2.2.....	79
7.3 MAIN RESULTS.....	79
THEOREM 7.3.1.....	79

SUMMARY AND CONCLUSION.....	84
REFERENCES.....	85

CHAPTER 1

INTRODUCTION

CHAPTER 1

INTRODUCTION

1.1 The Method of Upper and Lower solutions:

An interesting and fruitful technique for proving existence results for nonlinear problems is the method of upper and lower solutions. The basic idea is to modify the given problem suitably into a simpler problem, and then to employ known existence results of the modified problem, together with the theory of differential inequalities, to establish the existence results of the original problem. This method is sufficiently well known for boundary value problems whose study is substantially more difficult than that of initial value problems. Furthermore, the technique yields existence of solutions in a closed set, namely, the sector obtained by means of upper and lower solutions [8].

Generally speaking, the methods of proving existence results of nonlinear differential equations consist of three steps:

- (a) constructing a sequence of some kind of approximate solutions;
- (b) showing the convergence of the constructed sequence of approximate solutions; and
- (c) proving that the limit function is actually a solution of the given problem.

When we are dealing with continuous differential systems, steps (a) and (c) are standard and straightforward. It is step (b) that deserves attention and which leads, in turn, to three possibilities: it shows that the sequence of approximate solutions

- (1) is a Cauchy sequence in R ,
- (2) satisfies the assumptions of the Ascoli-Arzelà theorem [35], so that one can extract a uniformly convergent subsequence, or
- (3) is a monotone sequence that converges uniformly.