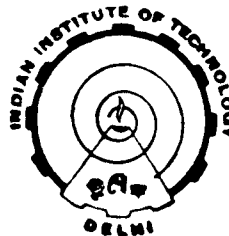


MATHEMATICAL PROGRAMMING DUALITY AND CONSTRAINED GAMES

BY

M. V. DURGA PRASAD

*THESIS SUBMITTED TO THE
INDIAN INSTITUTE OF TECHNOLOGY, DELHI
FOR THE AWARD OF THE DEGREE OF
DOCTOR OF PHILOSOPHY*



Department of Mathematics

INDIAN INSTITUTE OF TECHNOLOGY, DELHI

HAUZ KHAS, NEW DELHI-110016

INDIA

DECEMBER, 1989

... DEDICATED TO

FOND MEMORY OF MY

GRAND FATHER ...

CERTIFICATE

This is to certify that the thesis entitled "MATHEMATICAL PROGRAMMING DUALITY AND CONSTRAINED GAMES", which is being submitted by Mr. M.V. Durga Prasad for the award of the degree, DOCTOR OF PHILOSOPHY in MATHEMATICS, to the Indian Institute of Technology, Delhi, is a bonafide record of research work done under my guidance and supervision.

The thesis has reached the standard fulfilling the requirements of the regulations relating to the degree. The results obtained in this thesis have not been submitted to any other University or Institute for the award of any degree or diploma.


(SURESH CHANDRA)

Department of Mathematics
Indian Institute of Technology
Hauz Khas, New Delhi-110016

ACKNOWLEDGEMENTS

It is my privilege to express my profound sense of gratitude to my research supervisor Dr. Suresh Chandra for his invaluable guidance and constant encouragement throughout the course of my research work.

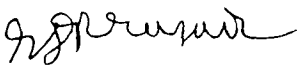
I am thankful to Prof. B. Mond, La Trobe University (Australia), Prof. C.R. Bector, University of Manitoba (Canada) and Prof. Chanchal Singh, St. Lawrence University (USA) for many useful discussions during their visits to the Department of Mathematics, I.I.T. Delhi.

I am also very grateful to Prof. N.S. Kambo, Head of the Mathematics Department for providing me research facilities and to Prof. M.M. Chawla and Prof. O.P. Bhutani for encouragement and interest in my work.

I am indebted to my family members for showering love and affection on me for further research. I cannot forget to remember and record my gratitude to my late grand father who initiated in me to do the research work.

I take this opportunity to thank my research colleagues P. Sambath Narayanan, Sarbeshwar Rout, Ms Vanita Verma and R.K. Mohanty for their various help they rendered at various stages of my stay at I.I.T. Delhi.

Finally, Shri D.R. Joshi deserves all praise for neat and intelligent typing of the manuscript.


(M.V. DURGA PRASAD)

CONTENTS

	Page No.
CHAPTER I	INTRODUCTION 1- 26
	1.0 General Introduction 1
	1.1 Preliminaries 3
	1.2 Review of Related Work 7
	1.3 Summary of Thesis 18
CHAPTER II	RATIO GAMES AND GENERALIZED FRACTIONAL PROGRAMMING DUALITY 27- 42
	2.0 Introduction 27
	2.1 Constrained Ratio Game 29
	2.2 Various Approaches to Generalized Fractional Programming Duality 32
	2.3 An Equivalence Result 36
CHAPTER III	NONLINEAR GAMES AND SYMMETRIC DUALITY 43- 69
	3.0 Introduction 43
	3.1 Convex-concave Games and Symmetric Duality 45
	3.2 Ratio Game Extension 55
CHAPTER IV	PSEUDOLINEAR FUNCTIONS AND MULTI OBJECTIVE PROGRAMMING DUALITY 70-103
	4.0 Introduction 70
	4.1 Duality in Pseudolinear Programming: A Direct Approach 71
	4.2 Pseudolinearity and Duality in Multi Objective Programming: A Linearization Approach 80
	4.3 Pseudolinear Vector Valued Games And Multi Objective Programming 89
CHAPTER V	DUALITY FOR A CLASS OF NONDIFFERENTIABLE MULTI OBJECTIVE PROGRAMMING PROBLEMS/VECTOR VALUED GAMES 104-148
	5.1 Introduction 104
	5.2 Non-Symmetric Duality 105
	5.3 Symmetric Dual Nondifferentiable Programs 124
	5.4 Convex-Concave Vector Valued Games and Multi Objective Programming 138

CHAPTER VI	CONTINUOUS PROGRAMS AND CONTINUOUS MATRIX GAME EQUIVALENCE	149-175
	6.1 Introduction	149
	6.2 Continuous Linear Programs	151
	6.3 Continuous Nonlinear Programs	161
APPENDIX	CONCLUSIONS	176
BIBLIOGRAPHY		178-186
