

ON SOME OPTIMAL PRODUCTION-INVENTORY
PROBLEMS IN FUZZY-ROUGH ENVIRONMENT

Final Report Submitted to the

UGC

For the Minor Research Project

(Ref. No - P.S.W. P.S.W. 092, 12/16 5170, 214 021,

Dated 5th Feb, 2013)

By

Dr. Kalipada Maiti

**ON SOME OPTIMAL PRODUCTION-INVENTORY
PROBLEMS IN FUZZY-ROUGH ENVIRONMENT**

Final Report submitted to the

UGC

For the Minor Research Project

(Ref. No- PSW/PSW092, 12/13 SNO. 214021, Dated 5th Feb. 2013)

By

Dr. Kalipada Maity

(Principal Investigator)

Assistant Professor in Mathematics

Mugberia Gangadhar Mahavidyalaya, Bhupatinagar

Purba Medinipur-721425, West Bengal, India

Contact No: 9434611354/9679297341

Contents

I Introduction and Methods/Techniques	1
1 Introduction	3
1.1 Introduction	3
1.2 What is Optimal Control Theory	4
1.3 The Maximum Principle	5
1.4 Statement of the problem	5
1.5 Application area	7
1.6 Historical Review of fuzzy or fuzzy-rough inventory models	7
1.7 Review of research and development in the subject	8
1.7.1 International Status	8
1.7.2 National Status	10
1.8 Motivation and Objective of the Project	11
1.9 Organization of the Project	12
2 Methodologies	13
2.1 Crisp Set Theory	13
2.2 What is Optimal Control Theory	14
2.3 Application area	15
2.4 Solution Techniques for Single Objective Problem in crisp environment	15
2.4.1 Bolza form	15
2.4.2 The Hamilton-Jacobi-Bellman equation	16
2.4.3 Euler's equation	18
2.4.4 Kuhn-Tucker's necessary and sufficient conditions for constraint optimization	19
2.4.5 Pontryagin Maximum Principle	19
2.4.6 Lagrange Function Method	21
2.5 Geometric Programming Method	21
2.5.1 Posynomial/Signomial Function	22
2.5.2 Posynomial Geometric Programming (PGP)	23
2.5.3 Signomial Geometric Programming	25
2.5.4 Generalized Geometric Programming Method	26
2.5.5 Modified Geometric Programming (MGP)	28
2.6 Solution Techniques for Multi-Objective Programming Problem in Crisp Environment	33
2.6.1 Global Criteria Method	33

27	Fuzzy Set Theory	34
27.1	Interval Mathematics	37
27.2	Possibility/Necessity/ Credibility in Fuzzy Environments	41
27.3	Expected Value of a Fuzzy Variable	44
28	Solution Techniques for Single-Objective Programming Problem in Fuzzy Environment	45
28.1	Single-objective programming problem in Fuzzy Environment	45
29	Necessary Knowledge About Fuzzy Rough Method	46
29.1	Single-objective Fu Ro Model	49
29.2	Equivalent crisp model for single objective problem with Fu Ro parameters	49
2.10	Necessary Knowledge About Liu-Uncertain Method	49
2.10.1	Uncertain single objective Problem	51
2.10.2	Equivalent crisp objective problem	52
II Production control inventory model in fuzzy-rough environment		53
3	Advertisement Policy, Reliability Dependent Imperfect Production and Environmental Pollution Control Problem in Fuzzy-Rough Environment	55
3.1	Abstract	55
4	Multi-item production inventory model with Fuzzy Rough coefficients via Geometric programming approach	57
4.1	Abstract	57
III Multi-item production inventory control model in fuzzy/Liu-uncertain environment		59
5	Numerical approach to an optimal multi-item imperfect production control problem in uncertain environment	61
5.1	Abstract	61
IV Summery and Future Research Work		63
6	Summery and Future Research Work	65
6.1	Summary of the project	65
6.2	Limitation and Future Research Scope	66
V Reference		67
7	References	69