

# Contents

<b>1</b>	<b>Mathematical Programming</b> .....	1
1.1	Single-Objective Programming .....	1
1.2	Multiobjective Programming .....	3
1.3	Goal Programming .....	4
1.4	Dynamic Programming .....	6
1.5	Multilevel Programming .....	7
<b>2</b>	<b>Genetic Algorithms</b> .....	9
2.1	Representation Structure .....	10
2.2	Handling Constraints .....	10
2.3	Initialization Process .....	10
2.4	Evaluation Function .....	11
2.5	Selection Process .....	12
2.6	Crossover Operation .....	12
2.7	Mutation Operation .....	13
2.8	General Procedure .....	13
2.9	Numerical Experiments .....	14
<b>3</b>	<b>Neural Networks</b> .....	19
3.1	Basic Concepts .....	19
3.2	Function Approximation .....	21
3.3	Neuron Number Determination .....	21
3.4	Backpropagation Algorithm .....	22
3.5	Numerical Experiments .....	23
<b>4</b>	<b>Stochastic Programming</b> .....	25
4.1	Random Variables .....	25
4.2	Expected Value Model .....	35
4.3	Chance-Constrained Programming .....	37
4.4	Dependent-Chance Programming .....	42

4.5	Hybrid Intelligent Algorithm .....	50
4.6	Numerical Experiments .....	54
<b>5</b>	<b>Fuzzy Programming</b> .....	<b>57</b>
5.1	Fuzzy Variables .....	57
5.2	Expected Value Model .....	68
5.3	Chance-Constrained Programming .....	70
5.4	Dependent-Chance Programming .....	74
5.5	Hybrid Intelligent Algorithm .....	76
5.6	Numerical Experiments .....	79
<b>6</b>	<b>Hybrid Programming</b> .....	<b>83</b>
6.1	Hybrid Variables .....	83
6.2	Expected Value Model .....	98
6.3	Chance-Constrained Programming .....	99
6.4	Dependent-Chance Programming .....	102
6.5	Hybrid Intelligent Algorithm .....	104
6.6	Numerical Experiments .....	107
<b>7</b>	<b>Uncertain Programming</b> .....	<b>111</b>
7.1	Uncertain Variables .....	111
7.2	Expected Value Model .....	118
7.3	Chance-Constrained Programming .....	119
7.4	Dependent-Chance Programming .....	121
7.5	Uncertain Dynamic Programming .....	122
7.6	Uncertain Multilevel Programming .....	124
7.7	$\Psi$ Graph of Uncertain Programming .....	127
<b>8</b>	<b>System Reliability Design</b> .....	<b>129</b>
8.1	Problem Description .....	129
8.2	Stochastic Models .....	130
8.3	Fuzzy Models .....	134
8.4	Hybrid Models .....	136
8.5	Exercises .....	137
<b>9</b>	<b>Project Scheduling Problem</b> .....	<b>139</b>
9.1	Problem Description .....	139
9.2	Stochastic Models .....	140
9.3	Fuzzy Models .....	143
9.4	Hybrid Models .....	145
9.5	Exercises .....	146
<b>10</b>	<b>Vehicle Routing Problem</b> .....	<b>147</b>
10.1	Problem Description .....	147
10.2	Stochastic Models .....	149

Contents	XI
10.3 Fuzzy Models .....	153
10.4 Hybrid Models .....	154
10.5 Exercises .....	155
<b>11 Facility Location Problem .....</b>	<b>157</b>
11.1 Problem Description .....	157
11.2 Stochastic Models .....	157
11.3 Fuzzy Models .....	160
11.4 Hybrid Models .....	163
11.5 Exercises .....	165
<b>12 Machine Scheduling Problem .....</b>	<b>167</b>
12.1 Problem Description .....	167
12.2 Stochastic Models .....	168
12.3 Fuzzy Models .....	172
12.4 Hybrid Models .....	175
12.5 Exercises .....	177
<b>References .....</b>	<b>179</b>
<b>List of Acronyms .....</b>	<b>197</b>
<b>List of Frequently Used Symbols .....</b>	<b>199</b>
<b>Index .....</b>	<b>201</b>