

Contents

<i>Preface</i>	vii
<i>Acknowledgments</i>	ix
1. Introduction	1
1.1 Case Study: Disruption Management at Continental Airlines	2
1.1.1 The Storm of the Century woke Continental Airlines up	3
1.1.2 CALEB Technologies responded to the call	4
1.1.3 Background of Continental Airlines	5
1.1.4 The Go-Forward plan and the CrewSolver project	6
1.1.5 Challenges in modeling, solutions, and real-time technology	8
1.1.6 The payback and the testimonials	10
1.1.7 The vision, the Franz Edelman Award, and the bright future	14
1.2 General Description of Disruption Management	16
1.3 Approaches to Uncertainties	18

1.4	General Guidance of Disruption Management	23
1.5	An Overview of the Book	25
1.6	Literature Review	27
2.	General Models for Disruption Management	31
2.1	Introduction	31
2.2	Goal Programming Models	32
2.2.1	Goal programming in general form	32
2.2.2	Goal programming models for disruption management of the shortest path problem . . .	36
2.3	A Scenario-based Model	40
2.4	Local Search Methods	45
2.5	Literature Review	49
3.	Disruption Management for Flight Scheduling	51
3.1	Introduction	51
3.2	Flight Scheduling Problems	52
3.3	Issues in Flight Rescheduling	54
3.4	Time-Space Network Models	57
3.4.1	Disruptions and network formulation	58
3.4.2	Mathematical models	60
3.4.3	Extensions and discussions	63
3.4.4	LP relaxations and rounding heuristics	66
3.4.5	Computational results	69
3.5	A Time Band Model	70
3.6	Set Packing Model	73
3.7	Literature Review	76

4.	Disruption Management for Airline Crew Scheduling	79
4.1	Introduction	79
4.2	Overview of Crew Scheduling Problem	80
4.3	Network Flow Formulation	82
4.4	A Heuristics Algorithm	85
4.4.1	Discussion on criteria selection	86
4.4.2	Branch and bound algorithm	87
4.4.3	Computational results and impacts	91
4.5	Integer Programming Model	94
4.5.1	Integer programming formulation	94
4.5.2	LP relaxation	95
4.5.3	Branching strategies	96
4.6	Related Literature	97
5.	Disruption Management for Machine Scheduling	101
5.1	Introduction	101
5.2	Problem Statement and Definitions	102
5.3	Disruption Management for an SPT Schedule	105
5.3.1	Post-disruption management for machine disruption	106
5.3.2	Post-disruption management for job disruption	107
5.3.3	Predictive management for machine disruption	109
5.3.4	Predictive management for job disruption . . .	113
5.4	Problems with Min-max Deviation Cost Functions . .	117
5.4.1	Post-disruption management for machine disruption	118
5.4.2	Post-disruption management for job disruption	118
5.4.3	Predictive management for machine disruption	120

5.4.4	Predictive management for job disruption . . .	122
5.5	Extensions to Parallel Machines	124
5.5.1	Post-disruption management for machine disruption	125
5.5.2	Post-disruption management for job disruption	128
5.5.3	Predictive management for machine disruption	129
5.5.4	Predictive management for job disruption . . .	131
5.6	Literature Review	131
6.	Disruption Management for Logistics Scheduling	135
6.1	Introduction	135
6.2	Problem Description	136
6.3	Minimizing Total Completion Time and Transportation Cost	139
6.3.1	Problem $P2 D = \infty, t^k, K^k \sum C_i + TC$	139
6.3.2	Problem $Pm D, t_j = 0, b \sum w_i C_i + TC$	142
6.4	Minimizing Only Job Completion Deviation Costs . .	144
6.4.1	Problem $P2 D = \infty, t L_{\max}$	144
6.4.2	Problem $P2 D, t L_{\max}$	147
6.4.3	Problem $Pm D, t_j = 0 \sum w_i U_i$	148
6.5	Minimizing Weighted Sum of Job Deviation Costs and the Original Objective Function	150
6.5.1	Problem $P2 D = \infty, t = 0 \alpha \sum w_i C_i + \beta \sum w_i T_i$	150
6.5.2	Problem $P2 D = \infty, t \alpha \sum w_i C_i + \beta \sum w_i T_i$. .	152
6.6	Literature Review	153
7.	Inventory Disruption Management Based on Eco- nomic Production Quantity Models	157
7.1	Introduction	157

7.2	Problem Formulation	158
7.2.1	Disruptions and disruption management policies	160
7.2.2	Deviation cost	162
7.3	Disruption Management with Fixed Setup Times . . .	163
7.3.1	General models	163
7.3.2	Minor disruptions	165
7.4	Disruption Management with Flexible Setup Times . .	168
7.5	Two-Stage Models	176
7.5.1	Case for fixed setup times	178
7.5.2	Case for flexible setup times	180
7.5.3	Special cases for minor disruptions	181
7.5.4	Two-stage model with multiple retailers	185
7.6	Related Literature	187
8.	Disruption Management for Discrete Production Planning Problems	191
8.1	Introduction	191
8.2	Problem Formulations	193
8.3	Dynamic Programming Algorithm	196
8.4	Case for Convex Cost Functions	197
8.4.1	Preliminaries	198
8.4.2	The greedy algorithm	202
8.4.3	Solving original production planning problems .	209
8.5	Numerical Examples and Computational Experiments	210
8.5.1	Numerical examples	210
8.5.2	Computational experiments	213
8.6	Related Literature	216

9.	Disruption Management for Supply Chain Coordination	219
9.1	Introduction	219
9.2	Supply Chain Coordination without Disruptions . . .	221
9.3	Centralized Decision Making with Demand Disruptions	224
9.3.1	Modeling of disruption management	224
9.3.2	Optimal policies under a demand disruption . .	225
9.3.3	Value of disruption management	230
9.4	Decentralized Decision Making after Demand Disruptions	231
9.4.1	Case 1 : $\Delta D \geq \lambda_1 k$	231
9.4.2	Case 2 : $0 < \Delta D \leq \lambda_1 k$	233
9.4.3	Case 3 : $-\lambda_2 k \leq \Delta D < 0$	234
9.4.4	Case 4 : $\Delta D < -\lambda_2 k$	236
9.4.5	Impact of disruption management on supply chain coordination	237
9.5	Extension to Nonlinear Demand Functions	240
9.5.1	Disruption management for centralized deci- sion making	240
9.5.2	Disruption management for supply chain coordination	242
9.6	Extensions to a Supply Chain with Two Retailers . . .	245
9.6.1	Model description	245
9.6.2	Supply chain coordination	248
9.6.3	Centralized decision making for demand disruptions	250
9.6.4	Supply chain coordination with demand disruptions	252
9.7	Literature Review	253

10. Disruption Management for Project Scheduling	257
10.1 Introduction	257
10.2 Modeling of Disruption Management for Project Scheduling	258
10.2.1 Types of disruptions	260
10.2.2 Options for disruption management	262
10.2.3 Objective function	262
10.2.4 Disruption management time window	264
10.2.5 ILP model	264
10.3 Some Special Cases	265
10.3.1 Resource-unconstrained case	265
10.3.2 Case with one non-renewable resource	269
10.3.3 Case with one renewable resource	270
10.4 A Hybrid MIP/CP Solution Approach	270
10.4.1 Procedure	272
10.4.2 Branch and cut	273
10.4.3 Constraint propagation	275
10.5 Numerical Examples	279
10.6 Computational results	284
10.7 Literature Review	286
11. Conclusion	289
<i>Index</i>	293