

Contents

Preface	v
CHAPTER 1	
Air Transportation: Irregular Operations and Control Michael Ball, Cynthia Barnhart, George Nemhauser and Amedeo Odoni	1
1 Introduction	1
2 Flow constraints in the infrastructure of commercial aviation	5
3 Restricting schedules	19
4 Air traffic flow management	23
5 Simulation models	38
6 Airline schedule recovery	40
7 Robust airline scheduling	50
8 Conclusions	60
Acknowledgements	61
References	61
CHAPTER 2	
Public Transit Guy Desaulniers and Mark D. Hickman	69
1 Introduction	69
2 Strategic planning	70
3 Tactical planning	86
4 Operational planning	94
5 Real-time control	112
6 Conclusion	120
References	120
CHAPTER 3	
Passenger Railway Optimization Alberto Caprara, Leo Kroon, Michele Monaci, Marc Peeters and Paolo Toth	129
1 Introduction	129
2 Line planning	133
3 Train timetabling	141
4 Train platforming	150

5 Rolling stock circulation	154
6 Train unit shunting	167
7 Crew planning	172
8 Perspective	182
References	183

CHAPTER 4

Maritime Transportation

Marielle Christiansen, Kjetil Fagerholt, Bjørn Nygreen and David Ronen	189
1 Introduction	189
2 Characteristics and terminology of maritime transportation	196
3 Strategic planning in maritime transportation	201
4 Tactical planning in maritime transportation	222
5 Operational planning	264
6 Robustness in maritime transportation	271
7 Perspectives and future research	276
8 Conclusion	279
Acknowledgements	280
References	280

CHAPTER 5

Dynamic Models for Freight Transportation

Warren B. Powell, Belgacem Bouzaïene-Ayari and Hugo P. Simão	285
1 Introduction	285
2 Some illustrative applications	286
3 A resource model	289
4 Modeling exogenous information processes	296
5 Decisions	306
6 System dynamics	309
7 An optimization formulation	311
8 Algorithmic strategies	312
9 Approximating value functions in dynamic programming	330
10 The organization of information and decisions	338
11 Illustrative models	341
12 Perspectives on real-time problems	362
References	362

CHAPTER 6

Vehicle Routing

Jean-François Cordeau, Gilbert Laporte, Martin W.P. Savelsbergh and Daniele Vigo	367
1 Introduction	367
2 The classical vehicle routing problem	368
3 The vehicle routing problem with time windows	385
4 The inventory routing problem	398
5 Stochastic vehicle routing problems	410

Acknowledgements	417
References	417
CHAPTER 7	
Transportation on Demand	
Jean-Francois Cordeau, Gilbert Laporte, Jean-Yves Potvin and Martin W.P. Savelsbergh	429
1 Introduction	429
2 The vehicle routing problem with pickup and delivery	431
3 The dial-a-ride problem	439
4 Urban courier service problems	445
5 The dial-a-flight problem	448
6 Ambulance fleet management	454
Acknowledgements	462
References	462
CHAPTER 8	
Intermodal Transportation	
Teodor Gabriel Crainic and Kap Hwan Kim	467
1 Introduction	467
2 Freight transportation systems	469
3 System and service network design	478
4 Container fleet management	495
5 Models for seaport container terminal operations	501
6 Strategic planning of multimodal systems	520
7 Perspectives	526
Acknowledgements	529
References	529
CHAPTER 9	
Hazardous Materials Transportation	
Erhan Erkut, Stevanus A. Tjandra and Vedat Verter	539
1 Introduction	539
2 A high-level view of hazmat logistics research	544
3 Risk assessment	551
4 Routing and scheduling	580
5 Facility location and transportation	599
6 Synthesis and future research directions	605
Acknowledgements	610
References	611
CHAPTER 10	
Traffic Equilibrium	
Patrice Marcotte and Michael Patriksson	623
1 Background	623
2 The basic theme	624

3 Variations	646
4 Solution algorithms: The basic problem	666
5 Solution algorithms: Variations	678
6 Optimization in a user equilibrium context	684
Appendix A: A primer on variational inequalities	702
Appendix B: A summary of key notations	706
References	706
CHAPTER 11	
ITS and Traffic Management	
M. Papageorgiou, M. Ben-Akiva, J. Bottom, P.H.L. Bovy, S.P. Hoogendoorn, N.B. Hounsell, A. Kotsialos and M. McDonald	715
1 Introduction	715
2 Traffic flow modeling	716
3 Route guidance and information systems	732
4 Urban network traffic control	743
5 Motorway traffic control	754
References	768
Subject Index	775