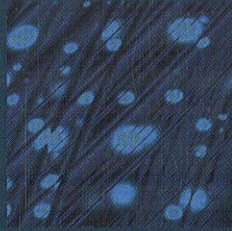




ENGINEERING SCIENCES



TRANSPORT SIMULATION BEYOND TRADITIONAL APPROACHES

Edward Chung and André-Gilles Dumont, Editors

EPFL Press
Distributed by CRC Press



TABLE OF CONTENTS

Preface	vii
About the Authors	xi

PART I	MACROSCOPIC TO VEHICLE-EMBEDDED MICROSCOPIC SIMULATION.....	1
CHAPTER 1	THE ROLE OF MACROSCOPIC MODELING IN THE SIMULATION, SURVEILLANCE AND CONTROL OF MOTORWAY NETWORK TRAFFIC	3
	<i>Markos Papageorgiou, Ioannis Papamichail, Yibing Wang</i>	
1.1	Introduction.....	3
1.2	Macroscopic modeling of motorway network traffic	5
	1.2.1 The non-destination-oriented model	6
	1.2.2 The destination-oriented model	8
	1.2.3 Model summary	10
	1.2.4 Model validation.....	11
1.3	Dynamic traffic assignment (DTA) and route guidance (RG).....	15
	1.3.1 Feedback strategies.....	15
	1.3.2 Iterative strategies.....	16
1.4	Motorway network traffic surveillance	18
1.5	Optimal control of motorway traffic	22
	1.5.1 Ramp metering.....	22
	1.5.2 Route guidance.....	24
	1.5.3 Integrated control	24
1.6	Conclusions.....	24
1.7	References.....	25

CHAPTER 2	HYBRID TRAFFIC SIMULATION MODELS: VEHICLE LOADING AT MESO-MICRO BOUNDARIES	27
	<i>Wilco Burghout, Haris N. Koutsopoulos</i>	
2.1	Introduction	27
2.2	Hybrid modeling framework	28
2.3	Modeling traffic dynamics at meso-micro boundaries	30
2.4	Vehicle loading	31
2.4.1	Vehicle loading in existing microscopic models	32
2.4.2	Proposed loading method	33
2.5	Case study	36
2.6	Conclusions	40
2.7	References	41
CHAPTER 3	SIMULATION OF VEHICLES IN A DRIVING SIMULATOR USING MICROSCOPIC TRAFFIC SIMULATION	43
	<i>Johan Janson Olstam</i>	
3.1	Introduction	43
3.2	The simulation model	46
3.2.1	The moving window	46
3.2.2	Generation of new vehicles	47
3.2.3	Sub-models for driving behavior and vehicle movement	48
3.2.4	The candidate areas	51
3.3	Validation	52
3.3.1	Overtaking rates	53
3.3.2	User evaluation	54
3.4	Concluding remarks and future research	56
3.5	Acknowledgments	57
3.6	References	57
PART II	LANE CHANGING	59
CHAPTER 4	INTEGRATED LANE-CHANGING MODELS	61
	<i>Moshe Ben-Akiva, Charisma Choudhury, Tomer Toledo</i>	
4.1	Introduction	61
4.2	Methodology	62
4.3	Integration of MLC and DLC	64

4.4	Explicit target lane choice	65
4.5	Cooperative and forced gap acceptance	67
4.6	Accounting for heterogeneity	70
4.7	Conclusions	72
4.8	Acknowledgments	73
4.9	References	73
CHAPTER 5	TRAFFIC SIMULATION OF A RURAL 2 + 1 HIGHWAY IN HOKKAIDO	75
	<i>Kazunori Munehiro, Toshio Kamiizumi, Mamoru Sasaki, Toshiya Uzuka, Motoki Asano</i>	75
5.1	Introduction	75
5.2	Study Sites	76
	5.2.1 Outline of the field survey on National Highway 38 in Shiranuka	76
	5.2.2 Results of the field survey on National Highway 38 in Shiranuka	77
5.3	SIM-R Traffic Micro-simulation Program	80
	5.3.1 Simulation outline	80
	5.3.2 Basic model for vehicle behaviors	82
5.4	Model of Lane-changing Behavior on a Rural 2 + 1 Highway	83
	5.4.1 Changing from the main lane to the left-hand auxiliary lane	83
	5.4.2 Re-entering the main lane from the left-hand auxiliary lane	85
5.5	Simulation Run	86
	5.5.1 Simulation requirements	86
	5.5.2 Simulation results	87
5.6	Discussion and Conclusions	91
	5.6.1 Field survey results for National Highway 38 in Shiranuka	91
	5.6.2 Lane-changing behavior model of rural 2 + 1 highways	91
	5.6.3 Calibration of parameters of the SIM-R traffic micro-simulation for the lane-changing behavior	91

	5.7	Acknowledgments	92
	5.8	References	92
CHAPTER 6		MECHANICAL RESTRICTION VS. HUMAN OVERREACTION: THE MODELING OF SYNCHRONIZED TWO-LANE TRAFFIC	93
		<i>Andreas Pottmeier, Christian Thiemann, Andreas Schadschneider, Michael Schreckenberg</i>	
	6.1	Introduction	93
	6.2	Model definition of the single lane model	94
	6.3	Stability of the model	96
	6.4	Two-lane traffic	97
	6.5	Two-lane model	98
	6.6	Results	99
	6.7	Summary and outlook	103
	6.8	References	104
PART III		PEOPLE-CENTERED AND RAIL SIMULATION	105
CHAPTER 7		PEDESTRIAN SIMULATION TAKING INTO ACCOUNT STOCHASTIC ROUTE CHOICE AND MULTIDIRECTIONAL FLOW	107
		<i>Miho Asano, Masao Kuwahara, Agachai Sumalee</i>	107
	7.1	Introduction	107
	7.2	Framework of an integrated dynamic pedestrian route choice and flow model	109
	7.3	Network-based route choice model	110
		7.3.1 Network structure for pedestrians	110
		7.3.2 Route generation and route choice	111
	7.4	Path choice model	113
	7.5	Flow propagation model	114
		7.5.1 Cell transmission model	115
		7.5.2 Modification of CTM	116
	7.6	Application to simple case studies	118
		7.6.1 Test for flow propagation model	118
		7.6.2 Network test	120
	7.7	Conclusions	122

	7.8	Acknowledgements	123
	7.9	References	123
CHAPTER 8		F.A.S.T. – FLOOR FIELD AND AGENT BASED SIMULATION TOOL	125
		<i>Tobias Kretz, Michael Schreckenberg</i>	
	8.1	Introduction	125
	8.2	A model of pedestrian motion	126
	8.3	Evacuation exercise in a primary school	128
		8.3.1 Results	129
		8.3.2 Comparison to simulation results	130
	8.4	Summary	133
	8.5	Appendix A: Equations	134
	8.6	Acknowledgments	135
	8.7	References	135
CHAPTER 9		INCORPORATING PATTERN-MATCHING INTO DATA-ORIENTED ACTIVITY SIMULATION USING PROBE PERSON SYSTEMS	137
		<i>Eiji Hato, Yasuo Asakura, Masuo Kashiwadani</i>	
	9.1	Background and objectives of study	137
	9.2	Preprocessing of location data	140
		9.2.1 Data processing	140
		9.2.2 Node index and data cube storage	140
	9.3	Pattern-matching method for location data	141
		9.3.1 Dot-matrix method	141
		9.3.2 Scoring model method	142
		9.3.3 Multidimensional scale alignment method	144
	9.4	Case study	145
	9.5	Simulation study	147
	9.6	Conclusion	149
	9.7	References	151
CHAPTER 10		SIMULATION OF URBAN RAIL OPERATIONS: MODELS AND CALIBRATION METHODOLOGY	153
		<i>Haris N. Koutsopoulos, Zhigao Wang</i>	
	10.1	Introduction	153
	10.2	The simulation model	154

	10.3	Calibration methodology	158
	10.4	Case study	160
	10.5	Conclusions	168
	10.6	Acknowledgments	168
	10.7	References	168
PART IV		SIMULATION APPLICATION	171
CHAPTER 11		TRAFFIC SIMULATION FOR AN EXPRESSWAY TOLL PLAZA BASED ON SUCCESSIVE VEHICLE TRACKING DATA	173
		<i>Ryota Horiguchi, Takahiro Shitama, Hirokazu Akahane, Jian Xing</i>	
	11.1	Introduction	173
	11.2	Massive tracking of vehicle trajectories	174
		11.2.1 Video survey and tracking	174
		11.2.2 Estimated trajectories	176
		11.2.3 Speed and acceleration	178
		11.2.4 Headway and capacity	180
	11.3	Modeling of traffic flow in toll plaza	181
		11.3.1 Flow modeling	181
		11.3.2 Lane choice behavior in the toll plaza	182
		11.3.3 Basic structure of lane choice model	185
		11.3.4 Split-side choice model and its calibration	187
		11.3.5 Target gate choice model and its calibration	188
		11.3.6 Lane change planning model	192
	11.4	Validation and Case Studies	193
		11.4.1 Reproducibility of lane choice behavior	193
		11.4.2 Validation of speed	195
		11.4.3 Count of ‘near-miss’ opportunities	195
	11.5	Case Studies	196
		11.5.1 Case-80-1	197
		11.5.2 Case-80-2	197
		11.5.3 Case-80-3	198
		11.5.4 Summary of the case studies	199

	11.6	Conclusions	200
	11.7	References	200
CHAPTER 12		TIME-DEPENDENT ORIGIN-DESTINATION ESTIMATION WITHOUT ASSIGNMENT MATRICES	201
		<i>Ramachandran Balakrishna, Moshe Ben-Akiva, Haris N. Koutsopoulos</i>	
	12.1	Introduction	201
	12.2	Methodology	205
	12.3	Case study I: Synthetic network	207
	12.4	Case study II: Los angeles, california	209
	12.5	Conclusion	211
	12.6	Acknowledgement	212
	12.7	References	212