

Table of Contents

Chapter Summary	xi
Chapter 1. Model Transformation: A Survey of the State of the Art	1
Tom MENS	
1.1. Model-driven engineering.	1
1.2. Model transformation	2
1.2.1. Definitions.	2
1.2.2. Taxonomy	4
1.3. Model transformation languages.	5
1.4. Model transformation activities	8
1.5. Conclusion	14
1.6. Acknowledgements	14
1.7. Bibliography	15
Chapter 2. Model-Based Code Generation	21
Chris RAISTRICK	
2.1. Introduction	21
2.2. The model-driven architecture (MDA) process . .	22
2.3. The automated approach to code generation. . . .	23
2.4. Domain modeling	25
2.5. The executable UML (xUML) formalism	29
2.6. System generation.	31

2.7. Executable UML to code mappings	34
2.8. Conclusions	41
2.9. Bibliography	42
Chapter 3. Testing Model Transformations: A Case for Test Generation from Input Domain Models	
Benoit BAUDRY	
3.1. Introduction	43
3.2. Challenges for testing systems with large input domains	46
3.2.1. Large set of input data	46
3.2.2. Configurable systems	48
3.2.3. Grammarware and model transformations .	48
3.2.4. Testing challenges	52
3.3. Selecting test data in large domains	52
3.3.1. Category partition	52
3.3.2. Combinatorial interaction testing	55
3.4. Metamodel-based test input generation.	58
3.4.1. Metamodel coverage criteria	59
3.4.2. Model and object fragments for test adequacy criteria	61
3.4.3. Discussion	64
3.4.4. Automatic synthesis of test models	65
3.5. Conclusion	67
3.6. Acknowledgements	68
3.7. Bibliography	68
Chapter 4. Symbolic Execution-Based Techniques for Conformance Testing	
Christophe GASTON, Pascale LE GALL, Nicolas RAPIN and Assia TOUIL	
4.1. Context	73
4.1.1. Conformance testing: an introduction	73
4.1.2. Conformance relation	74
4.1.3. An overview of the approach	78

4.2. Input output symbolic transition systems	79
4.2.1. Data types	79
4.2.2. Input/output symbolic transition systems . . .	80
4.2.3. Semantics	82
4.3. Symbolic execution	84
4.4. Conformance testing for IOSTS	87
4.4.1. Test purposes.	88
4.4.2. Preliminary definitions and informal description	89
4.4.3. Inference rules	94
4.5. Concluding remarks	96
4.5.1. Choosing test purposes	96
4.5.2. Implementation issues	101
4.6. Bibliography	101

**Chapter 5. Using MARTE and SysML for
Modeling Real-Time Embedded Systems** 105

Huascar ESPINOZA, Daniela CANCILA,
Sébastien GÉRARD and Bran SELIC

5.1. Introduction	105
5.2. Background	108
5.2.1. UML profiling capabilities.	108
5.2.2. SysML and MARTE modeling capabilities .	111
5.3. Scenarios of combined usage.	113
5.3.1. Defining architecture frameworks	114
5.3.2. Requirements engineering.	115
5.3.3. System-level design integration	117
5.3.4. Engineering/quantitative analysis	120
5.4. Combination Strategies	125
5.4.1. Issues	125
5.4.2. Strategies	128
5.5. Related work.	130
5.6. Conclusion	133
5.7. Acknowledgements	134
5.8. Bibliography	134

Chapter 6. Software Model-based Performance Analysis	139
Dorina C. PETRIU	
6.1. Introduction	139
6.2. Performance models	142
6.2.1. Queuing network models	144
6.2.2. Layered queuing network model	146
6.3. Software model with performance annotations. .	148
6.3.1. Performance domain model.	148
6.3.2. Source model example	152
6.4. Mapping from software to performance model .	155
6.5. Using a pivot language: Core Scenario Model (CSM)	158
6.6. Case study performance model.	160
6.7. Conclusions	162
6.8. Acknowledgements	163
6.9. Bibliography.	163
Chapter 7. Model Integration for Formal Qualification of Timing-Aware Software Data Acquisition Components	167
Jean-Philippe BABAU, Philippe DHAUSSY and Pierre-Yves PILLAIN	
7.1. Introduction	167
7.2. System modeling.	170
7.2.1. Acquisition system modeling.	170
7.2.2. Case study	172
7.2.3. Formal modeling techniques	174
7.3. Variation points modeling	182
7.3.1. Variation points definition	184
7.3.2. CDL implementation	187
7.4. Experiments and results	189
7.4.1. Tools.	189
7.4.2. Experimentations	191

7.5. Conclusion	194
7.6. Bibliography	195

**Chapter 8. SoC/SoPC Development using MDD
and MARTE Profile** 201

Denis AULAGNIER, Ali KOUDRI, Stéphane LECOMTE, Philippe SOULARD, Joël CHAMPEAU, Jorgiano VIDAL,
Gilles PERROUIN and Pierre LERAY

8.1. Introduction	201
8.2. Related works	203
8.3. MOPCOM process and models	206
8.4. Application	210
8.5. System analysis	211
8.5.1. Requirement analysis	211
8.5.2. Functional analysis	212
8.5.3. Action language	213
8.6. Abstract modeling level	214
8.7. Execution modeling level	216
8.7.1. The platform independent model/application model in EML	217
8.7.2. The platform model in EML	217
8.7.3. The platform specific model/allocation model in EML	218
8.7.4. Analysis model	219
8.8. Detailed modeling level	220
8.8.1. Platform model	221
8.8.2. Allocation model	222
8.9. Tooling Support	223
8.9.1. Process validation through metamodeling with Kermeta	223
8.9.2. Model transformation and generation with MDWorkbench platform	224
8.10. HDL Code Generation	225
8.10.1. VHDL code generation	226
8.10.2. Rhapsody integration	227
8.11. Conclusion	228

x Model-Driven Engineering

8.12. Acknowledgements	229
8.13. Bibliography	229
List of Authors	233
Index	237