Contents

1. Introduction **13**
- 1.1. Development Process and Related Issues . . . 15
- 1.2. Current Practice in Timing Verification . . . 17
- 1.3. Research Objective . . . 19
- 1.4. Contributions . . . 21
- 1.5. Outline . . . 22

2. Architectural Approach **23**
- 2.1. Related Work . . . 26
- 2.2. Design . . . 27
- 2.3. Implementation Options . . . 30
- 2.4. RTE Architecture and Update Protocol . . . 32

3. Distributed Performance Analysis **37**
- 3.1. Survey of System-Level Performance Analysis Algorithms . . . 37
- 3.2. System Modelling and Analysis Problem Definition . . . 39
- 3.3. Existence, Construction and Conservativity of a Least Fixed Point . . . 50
- 3.4. A distributed Analysis Algorithm . . . 76
- 3.5. Determining Convergence . . . 81
- 3.6. Conclusion . . . 86

4. An Execution Time Bound for Distributed Performance Analysis **87**
- 4.1. Bounding Execution Time of System Analysis . . . 87
- 4.2. Bounding Execution Time of Local Analysis Step Functions . . . 103
- 4.3. Empirical Evaluation of the Utility of Bounded-Time Approximations . 110
- 4.4. Conclusion . . . 136

5. Implementation and Evaluation **137**
- 5.1. General Considerations . . . 137
- 5.2. Update Manager, Overall Architecture . . . 139
- 5.3. Model Domain . . . 141
- 5.4. Execution Domain . . . 144
- 5.5. Demonstrator Implementation . . . 157
- 5.6. Conclusion . . . 161

6. Conclusion **163**
6.1. Future Research 166

A. A WCRT Bound Considering Convex Event Models **167**
A.1. Prior Art 167
A.2. Convex Activation 169
A.3. Multi-linear Individual Workload Approximation 171
A.4. Generic Properties of Piecewise Linear Concave/Convex Functions . . . 172
A.5. Multi-linear Combined Workload Bound 174
A.6. Response Time Bound for Multi-Linear Workload 176
A.7. Computing the Bound in Polynomial Time 180
A.8. Comparison with Prior Art 188
A.9. Conclusion 190

B. Publications **191**
B.1. With Relation to Thesis 191
B.2. Others 193