
Contents

Introduction	vii
I.1 Challenges in Declarative Static Analysis and Automated Synthesis of Specifications	ix
I.1.1 Declarative and effective program analysis	ix
I.1.2 Automated Inference of Specifications	x
I.2 The Proposed Approach	xii
I.3 Contributions of the Thesis	xiv
I.4 Plan of the Thesis	xv
1 Preliminaries	1
1.1 Rewriting Logic	1
1.2 Maude	2
I Datalog-based Declarative Program Analysis	9
2 Datalog and Boolean Equations Systems	15
2.1 Datalog	15
2.2 Datalog-based analysis	18
2.3 Parameterised Boolean Equation Systems	20
3 From Datalog to Boolean Equations Systems	23
3.1 From Datalog to BES.	24
3.2 A complete Datalog to BES transformation	25
3.2.1 Instantiation to parameterless BES	28
3.2.2 Optimizations to the basic BES resolution technique	32
3.2.3 Solution extraction	36
3.3 The prototype DATALOG_SOLVE	36
3.4 Experimental results	39
3.4.1 Further Improvements	40
3.5 Conclusions and Related Work	43

4	From Datalog to <i>Rewriting Logic</i>	45
4.1	From Datalog to RWL	46
4.2	A complete Datalog to RWL transformation	51
4.3	Dealing with JAVA reflection	71
4.4	The prototype DATA LAUDE	78
4.5	Experimental results	80
4.5.1	Comparison w.r.t. a previous rewriting-based implemen- tation	80
4.5.2	Comparison w.r.t. other Datalog solvers	81
4.6	Conclusions and Related Work	82
II	Automated Inference of Specifications	83
5	CURRY, the K Framework and <i>Matching Logic</i>	87
5.1	CURRY	87
5.2	The K Framework	91
5.3	<i>Matching Logic</i>	92
6	Inference of Specifications from CURRY Programs	95
6.1	Specifications in the functional-logic paradigm	96
6.2	Formalization of equivalence notions	99
6.3	Deriving Specifications from Programs	104
6.3.1	Pragmatical considerations	111
6.4	Case Studies	112
6.4.1	ABSPEC: The prototype	115
6.5	Conclusions and Related Work	117
7	Inference of Specifications from C Programs	119
7.1	Specification Discovery	121
7.2	Extending the ML Symbolic Machine	125
7.2.1	The MATCHC Extension	128
7.2.2	The Pattern Extraction	129
7.3	Inference process	130
7.3.1	Refining the inference process	134
7.4	A case study of specification inference	136
7.5	Conclusions and Related Work	142
	Conclusion and Future Work	145
	Bibliography	147