

Contents

Abstract	xi
List of Tables	xvii
List of Figures	xix
List of Symbols	xxiii
List of Abbreviations	xxv
1 Introduction	1
1.1 Program and Architectural Model Slicing	2
1.2 Motivation for Our Work	5
1.3 Objectives of Our Work	5
1.4 Overview of the Work Done	7
1.5 Applications of Model Slicing	9
1.6 Organization of the Thesis	9
2 Background Concepts	11
2.1 An Overview of UML 2.0	11
2.1.1 Taxonomy of UML 2.0 Models	11
2.1.2 Structural Model Constructs	13
2.1.3 Behavioral Model Constructs	14
2.2 Basic Concepts and Definitions	18
2.3 Precision and Correctness of Model Slices	19
2.4 Complexity of Model Slicing	20
2.4.1 Time Complexity of Slice Computation	20
2.4.2 Space Complexity of A Computed Slice	21
2.5 Conclusion	21
3 MDG: Our Proposed Metamodel	23
3.1 Relevant Issues in UML Models	23
3.1.1 Syntax and Semantics of Notes	23
3.1.2 Naming Elements of UML Class Models	24
3.1.3 Naming Interactions in UML Models	25
3.2 Basic Concepts and Definitions	26
3.3 MDG : A UML Metamodel	27

3.3.1	Elements of MDG	28
3.3.2	Mapping A UML Metamodel to MDG Representation	28
3.3.3	Representation of Dependencies in MDG	30
3.3.4	UML Model Views	30
3.4	Model Dependency Graph	30
3.4.1	MDG Nodes and Edges	32
3.4.2	Definition of MDG	34
3.4.3	MDG Construction Technique	35
3.4.4	Our <i>ModelGraph</i> Algorithm	35
3.4.5	Complexity Analysis of <i>ModelGraph</i>	39
3.5	Illustration of Working of <i>ModelGraph</i>	46
3.6	Proof of Concept	49
3.6.1	Prototype Tool <i>MDGConstructor</i>	49
3.6.2	Data Set Used in Experiments	50
3.6.3	Experimental Study	50
3.6.4	Experimental Results	52
3.7	Comparison with Related Work	56
3.8	Conclusions	59
4	Static Slicing of UML Models	61
4.1	Basic Concepts and Definitions	61
4.1.1	Static Slicing Terminologies	61
4.1.2	Some Definitions	64
4.1.3	MDG Traversal	65
4.1.4	Reverse-Mapping of UML Model Elements	68
4.2	Our SSUAM Methodology	68
4.2.1	Pseudo Code of SSUAM	69
4.2.2	Correctness of SSUAM	70
4.2.3	Complexity Analysis of SSUAM	71
4.3	Illustration of Working of SSUAM	76
4.4	Proof of Concept	81
4.4.1	Prototype Tool <i>ArchliceS</i>	81
4.4.2	Experimental Study	82
4.4.3	Experimental Results	84
4.5	Comparison with Related Work	89
4.6	Conclusions	91
5	Dynamic Slicing of UML Models	93
5.1	Basic Concepts and Definitions	93
5.1.1	Modified MDG Traversal	94
5.1.2	Dynamic Slicing Terminologies	96
5.2	Our DSUAM Methodology	98
5.2.1	Pseudo Code of DSUAM	99
5.2.2	Correctness of DSUAM	101
5.2.3	Complexity Analysis of DSUAM	102

5.3	Illustration of Working of DSUAM	105
5.4	Proof of Concept	112
5.4.1	Prototype Tool <i>ArchliceD</i>	113
5.4.2	Experimental Study	113
5.4.3	Experimental Results	114
5.5	Comparison with Related Work	123
5.5.1	Comparison between DSUAM and SSUAM Algorithms	126
5.6	Conclusions	127
6	Slicing With State Information	129
6.1	Basic Concepts and Definitions	129
6.1.1	Labelling of State Machines in UML Models	130
6.1.2	Representation of State Machines	130
6.1.3	Incorporation of an Object's State Information in MDG	131
6.1.4	Utilization of State Information for Improving Precision of Computed Slices	135
6.2	The Modified MDG Construction Technique	136
6.2.1	Handling State Models in <i>ConstructMDG()</i> Procedure	136
6.2.2	The Modified <i>ModelGraph</i> Algorithm	138
6.3	Our SDSUM Methodology	139
6.3.1	Pseudo Code of SDSUM	139
6.3.2	Precision and Correctness of SDSUM	141
6.3.3	Complexity Analysis of SDSUM	142
6.4	Illustration of Working of SDSUM	144
6.5	Proof of Concept	150
6.5.1	Prototype Tool <i>ArchliceDE</i>	151
6.5.2	Experimental Study	152
6.5.3	Experimental Results	154
6.6	Comparison with Related Work	160
6.6.1	Comparison between SDSUM and DSUAM Algorithms	164
6.7	Conclusions	166
7	Conclusions and Future Work	167
7.1	Contributions of the Thesis	167
7.2	Directions for Future Research	169
A	Illustrative UML Models	171
A.1	Example-1 UML Model	171
A.2	Example-2 UML Model	172
	List of Publications from the Thesis	175
	Bibliography	176

Copyright
IIT Kharagpur