

Contents

ABSTRACT

PREFACE

0 INTRODUCTION	1
0.1	Notational Conventions 7
1 TRACE THEORY	9
1.0	Introduction 9
1.1	Trace structures and commands 10
1.1.0	Trace structures 10
1.1.1	Operations on trace structures 10
1.1.2	Some properties 11
1.1.3	Commands and state graphs 13
1.2	Tail recursion 16
1.2.0	Introduction 16
1.2.1	An introductory example 16
1.2.2	Lattice theory 17
1.2.3	Tail functions 18
1.2.4	Least fixpoints of tail functions 20
1.2.5	Commands extended 21
1.3	Examples 23
2 SPECIFYING COMPONENTS	25
2.0	Introduction 25
2.1	Directed trace structures and commands 25
2.2	Specifications 28
2.2.0	Introduction 28
2.2.1	WIRE components 29
2.2.2	CEL components 29
2.2.3	RCEL and NCEL components 30
2.2.4	FORK components 31
2.2.5	XOR components 31
2.2.6	TOGGLE component 32
2.2.7	SEQ components 32
2.2.8	ARB components 33
2.2.9	SINK, SOURCE and EMPTY components 34
2.3	Examples 34
2.3.0	A conjunction component 34
2.3.1	A sequence detector 35
2.3.2	A token-ring interface (0) 36

2.3.3	A token-ring interface (1)	36
2.3.4	The dining philosophers	39
3	DECOMPOSITION AND DELAY-INSENSITIVITY	41
3.0	Introduction	41
3.1	Decomposition	42
3.1.0	The definition	42
3.1.1	Examples	44
3.1.2	The Substitution Theorem	48
3.1.3	The Separation Theorem	53
3.2	Delay-insensitivity	57
3.2.0	DI decomposition	57
3.2.1	DI components	58
4	DI GRAMMARS	63
4.0	Introduction	63
4.1	Udding's classification	64
4.2	Attribute grammars	66
4.3	The context-free grammar of G_4	66
4.4	The attributes of G_4	67
4.5	The conditions of G_4	69
4.6	The evaluation rules of G_4	72
4.7	Some DI grammars	74
4.8	DI Grammar GCL'	75
4.9	Examples	76
5	A DECOMPOSITION METHOD I	
	SYNTAX-DIRECTED TRANSLATION OF COMBINATIONAL COMMANDS	83
5.0	Introduction	83
5.1	Decomposition of \mathcal{L}_1 into \mathcal{L}_0	87
5.2	Decomposition of $\mathcal{L}(GCL')$	88
5.3	Decomposition of $\mathcal{L}(GCL0)$	90
5.3.0	Decomposition of semi-sequential commands	90
5.3.1	The general decomposition	91
5.4	Decomposition of XOR, CEL, and FORK components	92
5.5	Decomposition of $\mathcal{L}(GCL1)$	93
5.6	Decomposition of $\mathcal{L}(GCAL)$	95
5.6.0	Introduction	95
5.6.1	Conversion to 4-cycle signalling	95
5.6.2	Decomposition of 4-cycle CAL components into $B1$	96
5.6.3	Decomposition of 4-cycle CAL components into $B0$	97
5.7	Schematics of decompositions	99

6 A DECOMPOSITION METHOD II	
SYNTAX-DIRECTED TRANSLATION OF NON-COMBINATIONAL COMMANDS	101
6.0 Introduction	101
6.1 Decomposition of \mathcal{L}_2 into \mathcal{L}_1	102
6.1.0 Introduction	102
6.1.1 An example	102
6.1.2 The general decomposition	104
6.1.3 Schematics of decompositions	106
6.2 Decomposition of \mathcal{L}_3 into \mathcal{L}_2	108
6.2.0 Introduction	108
6.2.1 DI grammar <i>GSEL</i>	110
6.2.2 An example	110
6.2.3 The general decomposition	112
6.2.4 Decomposition of $\mathcal{L}(GSEL)$	114
6.2.5 A linear decomposition of $\mathcal{L}(GSEL)$	118
6.2.6 Decomposition of SEQ components	123
6.3 Decomposition of \mathcal{L}_4 into \mathcal{L}_3	125
7 SPECIAL DECOMPOSITION TECHNIQUES	128
7.0 Introduction	128
7.1 Merging states and splitting off alternatives	128
7.2 Realizing logic functions	134
7.3 Efficient decompositions of $\mathcal{L}(G3')$	137
7.4 Efficient decompositions using TOGGLE components	139
7.5 Basis tranformations	141
7.6 Decomposition of any regular DI component	143
8 CONCLUDING REMARKS	148
APPENDIX A	153
APPENDIX B	161
B.0 Introduction	161
B.1 The Theorems	164
B.2 Proofs of Theorems B.0 through B.2	169
B.3 Proofs of Theorems B.3 through B.5	173
B.4 Proofs of Theorems B.6 through B.9	187
B.5 Proofs of Theorems B.10 through B.16	201
REFERENCES	211
INDEX	214