
Contents

1	Polynomial Elimination at Work	1
1.1	Solving Polynomial Equations	1
1.2	Proving Geometric Theorems	4
1.3	Locating Singular Points	9
1.4	Decomposing Algebraic Curves	13
2	The Epsilon Library	15
2.1	What Is ϵ SILON and What It Does	15
2.2	Design and Implementation	16
2.3	ϵ SILON Functions	18
2.4	Some Experiments	24
2.5	Interface, Availability, and Installation	26
3	The CharSets Package	28
3.1	Introduction	28
3.2	CharSets Functions	29
3.3	Differential Module	35
3.4	Implementation Strategies	40
3.5	Experiments and Remarks	45
4	The TriSys and SiSys Modules	50
4.1	Introduction	50
4.2	TriSys Functions	51
4.3	Differential Triangular Series	55
4.4	SiSys Functions	57
4.5	Implementation Issues and Comparisons	60
5	The GEOTHER Environment	66
5.1	Specification of Geometric Theorems	66
5.2	Basic Translations	68
5.3	Proving Geometric Theorems Automatically	70
5.4	Automated Generation of Diagrams and Documents	72

5.5	Nondegeneracy Conditions and Miscellaneous Functions	73
5.6	Implementation Strategies	76
5.7	Experiments with Algebraic Provers	80
6	Relevant Elimination Tools	82
6.1	Implementations of Triangular Sets	82
6.2	Gröbner Bases Packages	85
6.3	Computing Resultants and Subresultants	89
6.4	Miscellaneous Functions	91
7	Solving Polynomial Systems	95
7.1	General Principles	95
7.2	Solving Zero-dimensional Systems	97
7.3	Solving Systems of Positive Dimension	107
7.4	Solving Parametric Systems	110
8	Automated Theorem Proving and Discovering in Geometry	115
8.1	A Simple Algebraic Approach	115
8.2	Proving Theorems via Zero Decomposition	121
8.3	Illustration with Examples	125
8.4	Discovering Geometric Theorems	135
9	Symbolic Geometric Computation	144
9.1	Deriving Locus Equations	144
9.2	Implicitizing Parametric Objects	156
9.3	Computing Offsets	161
9.4	Blending Algebraic Surfaces	166
9.5	Decomposing Algebraic Varieties	172
10	Selected Problems in Computer Mathematics	177
10.1	Computation with Polynomial Ideals	177
10.2	Factorization of Polynomials	181
10.3	Qualitative Study of Differential Equations	185
10.4	Automated Reasoning in Differential Geometry	193
A	Polynomial Systems: 50 Test Examples	200
B	Algebraic Factorization: 55 Examples	202
	References	207
	Index	215